A CATALOGUE OF CRUDE OIL AND OIL PRODUCT PROPERTIES

(1990 version)

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A CATALOGUE OF CRUDE OIL AND OIL PRODUCT PROPERTIES
(1990 version)

by:

Mark Bobra
Sandra Callaghan
Consultchem
Ottawa, Canada

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Environmental Protection Directorate
River Road Environmental Technology Centre
Ottawa K1A 0H3

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ABSTRACT

This catalogue provides data on various physical-chemical properties of crude oils and petroleum products. The properties that are reported are those which will likely determine the environmental behaviour and effects of spilled oil. The oils are arranged in alphabetical order.

RESUME

Ce catalogue fournit des données sur diverses propriétés physico-chimiques des huiles brutes et des produits pétroliers. Les propriétés énumérées détermineront probablement le comportement environnemental et les effets des hydrocarbures déversés. La liste des huiles et des produits pétroliers est présentée par ordre alphabétique.

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FOREWORD

The information contained in this report was compiled by Mr. M. Bobra and Ms. S. Callaghan of Consultchem under contract to Environment Canada. This catalogue is based on a document initially prepared by Mr. P.T. Chung of S.L. Ross Environmental Research Limited. This is the fourth edition of the catalogue.

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1.0 INTRODUCTION

This catalogue is a compilation of available data on crude oils and petroleum products. The emphasis of the catalogue is upon oils which could potentially impact the North American environment. Other oils which are unlikely to be of direct Canadian concern are also included because they have been well characterized and used in relevant studies. The properties listed for each oil are those which will provide an indication of a spilled oil's environmental behaviour and effects.

Most of the chemical-physical properties listed in this catalogue were measured using standard tests, such as ASTM test methods. Certain properties which are reported do not have standard test methods; examples of such properties are aqueous solubility and toxicity. The reader who wishes to make use of such data should refer directly to the original source to obtain specific details on the techniques and parameters used. Since data from many sources are cited, differences in reported values may be due to the variance of samples and inherent differences in measurement techniques.

The oils are arranged in alphabetical order. The names used to identify the oils in this catalogue are those used by the authors of the original data or by the suppliers of the samples. The reader should be aware of the following points when searching for information on a specific oil. Crude oils from the same region are often given the same name even though oils from different wells can have markedly different properties. Oils which are transported are often blends of different crude oils, and the relative proportions of component oil frequently change. Therefore, the physical and chemical properties will vary. Similarily, the properties of oil taken from an individual well can vary with the depth of the well and the year of production. Also, there may be the possibility that different authors refer to the same crude oil by different names. The refined products are indexed according to their most commonly used names and any synonyms are cross referenced in the Table of Contents.

For certain properties, data is given at different temperatures and for different degrees of oil weathering. An oil's degree of weathering is expressed as the volume or weight percent evaporated from the fresh oil. Weathered oils used for testing by the Environmental Emergencies Technology Division (EETD) were artificially weathered by gas stripping following the method of Mackay and Stiver (Mackay 1982a, Mackay 1983b). Equations are reported to describe the effects of temperature and weathering on some properties. Note that these equations are applicable only to the temperature and weathering range of the original data.

When data was not available for some properties, blank spaces were allocated in their places in order to facilitate future updating. The following abbreviations are used in the data sections: N/A (not applicable); N/M (not measurable); MAX (maximum); MIN (minimum); ND (not detected); and MW (molecular weight); DNF (did not flow).

2.0 DESCRIPTION OF DATA

2.1 Type

The type of crude or oil product is specified and any other relevant information is provided in this section.

2.2 API Gravity

API gravity is defined as:

$$\text{API Gravity} = \frac{141.5}{\text{Specific Gravity } (60/60^{\circ}\text{F})} - 131.5$$

where Specific Gravity (60/60°F) is the oil density at 60°F (15.6°C) divided by the density of water at 60°F (ASTM D 287, ASTM D 1298).

2.3 Density

Density is defined as the mass of a unit volume of oil at a specified temperature and has the units g/mL (Speight 1980, ASTM D 941, ASTM D 1217, ASTM D 1298, ASTM D 4052). The density of crude oils and oil products are dependent on temperature and degree of weathering. A convenient equation to express density at different temperatures and degrees of weathering (Mackay 1983a) is:

$$p = p_o + C_1F - C_2(T - T_s)$$

where: p is density at T and F (g/mL)
p_o is density of fresh oil at T_s (g/mL)
C_1,C_2 are constants
F is fraction of oil weathered
T is temperature of oil (°C)
T_s is standard temperature (°C)

Results reported from EETD were measured using an Anton Paar densiometer and following ASTM method D 4052.

2.4 Viscosity

Viscosity is a measure of a fluid's resistance to flow. It is defined as:

$$\text{Dynamic Viscosity} = \frac{\text{Shear Stress}}{\text{Rate of Shear}}$$

The units for dynamic viscosity are millipascal seconds (mPa.s) or centipoise (cP) (ASTM D 2532, ASTM D 2983).

Kinematic viscosity is defined as:

$$\text{Kinematic Viscosity} = \frac{\text{Dynamic Viscosity}}{\text{Density}}$$

The unit for kinematic viscosity is mm^2/sec or centistoke (cSt) (ASTM D 445).

Viscosity is dependent upon temperature and the degree of weathering (Mackay 1983a) as follows:

$u = u_o \exp(C_3F) \exp(C_4 (1/T_k - 1/T_{ks}))$

where: u is viscosity at F and T_k (mPa.s)
u_o is viscosity of fresh oil at T_{ks} (mPa.s)
C_3,C_4 are constants
F is fraction of oil weathered
T_k is temperature of oil (Kelvin, T_k = °C + 273)
T_{ks} is standard temperature (Kelvin)

Prior to 1989, the dynamic viscosity results reported from EETD were measured using a Brookfield LVT viscometer. For non-Newtonian oils the viscosity measurements were performed at the lowest possible shear rate. The kinematic viscosity results reported from EETD were measured using Zeitfuchs cross-arm capillary viscometers and following ASTM method D 445. Unless otherwise stated, viscosity data cited from EETD 1989 were determined using a Haake RV20 Rotoviscometer equipped with a M5/SV1 sensor.

2.5 Interfacial Tensions

Interfacial tension is the force of attraction between the molecules at the interface of a liquid (Fingas 1979). An indication of both the oil-air and oil-water interfacial tension is essential for calculating spreading rates and the likely extent to which the oil will form oil-in-water and water-in-oil emulsions (Mackay 1983a).Interfacial tensions are commonly measured by the de Nouy ring technique in which the force required to draw a platinum-iridium ring through the interface is measured (Mackay 1983a, ASTM D 971, ASTM D 2285). The units for interfacial tension are mN/m (or dynes/cm). The results reported from EETD were obtained using a Fisher Surface Tensiometer Model 21 and following ASTM method D 2285.

The effect of weathering on interfacial tensions (Mackay 1983a) is shown below:

$$S_{OA} = S_{OAo} + C_5F$$

where: S_{OA} is oil-air interfacial tension at F(mN/m)
S_{OAo} is oil-air interfacial tension of fresh oil (mN/m)
C_5 is a constant
F is fraction of oil weathered

$$S_{OW} = S_{OWo} + C_6F$$

where: S_{OW} is oil-water interfacial tension at F (mN/m)
S_{OWo} is oil-water interfacial tension of fresh oil (mN/m)
C_6 is a constant
F is fraction of oil weathered

2.6 Pour Point

Pour point is the lowest temperature, expressed as a multiple of 3 °C, at which the oil sample is observed to flow when cooled under prescribed conditions (ASTM D 97). After preliminary heating, the oil sample in a test jar is cooled at a specified rate by immersion into cooling baths kept at different temperatures. The lowest temperature at which movement of oil is observed in the test jar is recorded as the pour point (in °C).

Pour point is affected by weathering (Mackay 1983a) and can be expressed as follows:

$$PP = PP_o (1 + C_7F)$$

where: PP is pour point (°C)
PP_o is pour point of fresh oil (°C)
C_7 is a constant
F is fraction of oil weathered

2.7 Flash Point

Flash point is the lowest temperature, corrected to one atmosphere (101.3 kPa), at which vapours above an oil sample ignite in air when exposed to a flame under specified test conditions. Flash point can be measured by Cleveland Open-cup, Tag Closed-cup and Open-cup, Pensky-Martens Closed-cup, and Setaflash Closed Testers. Generally, the oil sample in the open-cup type testers is heated in an open vessel to a selected temperature. A test flame is introduced over the surface of the oil to determine whether the vapours ignite. If the vapours fail to ignite, the temperature of the oil sample is raised at a specified rate and the process repeated. In closed-cup testers, the oil sample is enclosed until a test flame is applied at a specified temperature. If the flash point is not reached, the oil sample is covered and the oil temperature is increased at a specified rate and the procass is repeated. Loss of volatiles from the oil samples is reduced in this procedure (TSB 1984, ASTM D 92, ASTM D 56, ASTM D 1310, ASTM D 93, ASTM D 3278, Lance 1979).

In the data section, flash points determined by open-cup and closed-cup type testers are designated by "(O.C.)" and "(C.C.)", respectively. No designation is provided if the testing method is not known.

The effect of weathering on flash point (Mackay 1983a) is:

$$L = L_o \ (1 + C_8 F)$$

where: L is flash point at F (°C)
L_o is flash point of fresh oil (°C)
C_8 is a constant
F is fraction of oil weathered

The results reported from EETD were obtained using a Pensky-Martens closed-cup tester and following ASTM method D 93.

2.8 Vapour Pressure

Vapour pressure is the pressure that a vapour exerts on its surroundings. Its units are kPa corrected to one atmosphere (101.3 kPa). Vapour pressure can be measured by a variety of methods including Reid, dynamic, static, isoteniscopic, vapour pressure balance and gas saturation. The most commonly used method for crude oils has been the Reid vapour pressure which measures vapour pressure at 37.8 °C (100 °F). It is measured by saturating a known volume of oil in an air chamber of known volume and measuring the equilibrium pressure which is then corrected to one atmosphere (101.3 kPa) (ASTM D 323, ASTM D 2551, ASTM D 2879, OECD 1981, TSB 1984, USEPA 1982).

The results reported from EETD are Reid vapour pressure determinations (ASTM D 323).

2.9 Distillation Data

Distillation data provides an indication of an oil's volatility and relative component distribution. Numerous techniques are available for determining the distillation curve (ASTM D 86, ASTM D 216, ASTM D 285, ASTM D 1160, ASTM D 2892).

Unless otherwise stated, the data reported in the catalogue are presented as volume percent recovered versus the measured vapour temperature. The results reported from EETD were obtained using the distillation method described by Mackay and Stiver (Mackay 1984) where both the oil's liquid and vapour temperatures are recorded.

The following definitions are useful:

Initial boiling point (IBP) is the temperature observed when the first drop of condensate falls from the lower end of the condenser tube.

End point or Final boiling point (FBP) is the maximum temperature obtained during the test. This usually occurs after the evaporation of all liquid from the bottom of the flask.

Percent recovered is the volume in millilitres of condensate collected in a receiving graduated cylinder, at a recorded temperature.

2.10 Emulsion Formation Tendency and Stability

A water-in-oil emulsion (colloquially named "chocolate mousse") is a stable emulsion of small droplets of water incorporated in oil. Oil spilled on a water surface may form stable water-in-oil emulsions which can have very different characteristics than the parent crude oil.

The tendency for a crude oil to form a water-in-oil emulsion is measured using a test method based on the rotating flask apparatus of Mackay and Zagorski (Mackay 1982a, Mackay 1984). Three hundred millilitres of artificial seawater and 30 mL of oil are placed in a 500 mL Fleaker (oil to water ratio of 1:10), and the Fleaker is sealed. The Fleaker is rotated for one hour at a rotation speed of 65 rpm and then allowed to settle for 30 minutes. The fraction of oil that forms an emulsion, f, is determined by measuring the height of the emulsion and the height of the unemulsified oil. Three additional mixing/settling cycles are performed with measurements of f taken at each rotation interval. The tendency of an oil to form an emulsion is given by $f_{initial}$ which is obtained by plotting f versus time, and by extrapolating f to time zero.

The following criteria were used to classify the tendency of a crude oil to form a stable emulsion (Mackay 1982a):

Range of $f_{initial}$	Emulsion Formation Tendency
0.0 to 0.25	Not likely
0.25 to 0.75	Fairly likely
0.75 to 1.0	Very likely

The stability of a water-in-oil emulsion is obtained by allowing the emulsion to settle for an additional 24 hours, and then measuring the fraction of oil in the emulsion (f_{final}) visually. The stability of the water-in-oil emulsion is classified (Mackay 1982a) as follows:

Range of f_{final}	Emulsion Stability
0.0 to 0.25	Unstable
0.25 to 0.75	Fairly stable
0.75 to 1.0	Very stable

The calculated water content of stable water-in-oil emulsions is also provided.

2.11 Weathering

Weathering of crude oils in the environment can be estimated from the modified distillation curve described by Stiver and Mackay (Stiver 1984). The oil's liquid temperature is monitored instead of the temperature of the saturated vapour as in standard distillation methods. From the gradient and the initial boiling temperature of the distillation curve (a plot of oil temperature versus fraction of oil condensed), the fraction of oil weathered under environmental conditions can be estimated. This estimation method is not very accurate for prolonged weathering of oil spills. At low environmental temperatures, some oils have a tendency to form a surface layer that may reduce the evaporation rate. This estimation method does not apply to refined petroleum products (Mackay 1982a, Mackay 1983b).

The calculation procedure is as follows:

(1) Obtain or estimate the following:

- average environment temperature (T_k) in Kelvin (Kelvin = °C + 273)

- volume of the oil spill (V) in m^3,

- area of the oil spill (A) in m^2,

- duration of oil spill (t) in seconds,

- average wind speed in m/s,

(2) Calculate mass transfer coefficient (K) in m/s:

$K = 0.002 \text{ (wind speed)}^{0.78}$

(3) Calculate evaporative exposure (θ):

$\theta = K A t / V$

θ can also be calculated if the thickness (in m) of the oil slick can be estimated:

$\theta = K t / \text{thickness}$

(4) Calculate fraction (by volume) of oil weathered:

$$F_v = \frac{\ln(1 + 10.3\, T_G\ \theta \exp(6.3 - 10.3\, T_o/T_k) / T_k)}{(10.3\, T_G / T_k)}$$

where: F_v is fraction of oil weathered by volume
ln is natural log (or take log base 10 and multiply by 2.3)
T_o is initial boiling point of modified distillation curve (Kelvin)
T_G is gradient of modified distillation curve (Kelvin)
exp is exponential base e
T_k is environmental temperature (Kelvin, K=°C + 273)

2.12 Dispersibility

Chemical dispersibility provides a relative indication of how effective a dispersant might be in dispersing oil spilled at sea. Similarly, natural dispersibility provides an indication of an oil's tendency to naturally disperse. Prior to 1989, the Mackay-Nadeau-Steelman (MNS) apparatus described by Mackay and Szeto (Mackay 1980b) was used to test dispersibility. This test consists of a 30cm diameter vessel containing 6 liters of sea water, onto which 10 mL of oil is placed, followed by a known volume of dispersant if chemical dispersibility is being tested. A tangentially introduced air stream produces a circular wave motion of the surface water. A water sample is taken from a fixed location in the vessel after a mixing period of 10 minutes and is analyzed for oil content. The percentage of oil dispersed into the water column is calculated and is expressed as a weight percent of the initial volume of oil added.

EETD laboratories now use the swirling flask apparatus as described by Fingas (Fingas 1987, Fingas 1990) for assessing the effectiveness of dispersants. The values reported represent a compilation of data from three variations of the swirling flask test: the one-drop, two-drop, and premixed oil dispersant mixtures. Average values for the percent effectiveness of the dispersants for all three tests are the recorded values. The oil-to-water ratio for all three tests is 1:1200. The oil-to-dispersant ratio for premixed samples is 25:1, whereas the oil-to-dispersant ratio for the one-drop and two-drop tests is 10:1. For the latter tests, the dispersant is applied in a dropwise fashion to the surface of the oil slick. Four dispersants were tested and their percent effectiveness recorded. Testing was performed on production grade Corexit 9527(Exxon), Corexit CRX-8(Exxon), Enersperse 700(British Petroleum), and Dasic(Dasic International).

Natural dispersibility was determined using the Labofina test method as described by Daling (Daling 1988a) and Fingas (Fingas 1987). 250 mL of artificial seawater and 250 µL of oil are placed in a 250mL separatory funnel resulting in an oil-to-water ratio of 1:1000. The separatory funnel is rotated at 33 rpm for 10 minutes and allowed to settle for 5 minutes. A 30 mL sample of water is removed through the funnel spout. The water is extracted with three 5 mL aliquots of dichloromethane and analyzed colormetrically at 340, 370, and 400 nm. Reported values represent percent dispersed at 15°C.

2.13 Hydrocarbon Group Analysis

The main constituents of any oil are generally grouped into four broad classes of chemicals. These are:

Saturates:	Saturated alkanes with structures of C_nH_{n+2} or C_nH_{2n}. Also called paraffins, alkanes, and aliphatics.
Aromatics:	Compounds that have a benzoid ring as part of their chemical structure.
Polars:	Polar compounds which contain oxygen, nitrogen, and sulphur atoms, and have strong adsorption tendencies. Also called resins.
Asphaltenes:	Asphaltenes are defined by their solubility behaviour; asphaltenes are soluble in aromatic solvents and insoluble in alkane solvents. Asphaltenes are generally considered to consist of condensed aromatic nuclei which may carry alkyl and alicyclic systems with heteroatoms such as nitrogen, sulphur, oxygen, and trace elements of nickel vanadium, and sodium.

The above definitions may be overly simplistic given the complex chemical composition of petroleum. A greater appreciation of oil chemistry and of how petroleum can be chemically fractionated can be obtained from more detailed texts such as the one by Speight (Speight 1980).

Saturate, aromatic and polar contents can be determined using various techniques such as open column chromatography or HPLC (ASTM D 936, ASTM D 1319, ASTM D 2007, ASTM D 2549). It should be noted that each technique will likely yield different results. Prior to 1989, EETD used hexane as the precipitating medium for determining asphaltene content. For 1989 and later years, EETD has used n-pentane for the precipitation medium as described by Daling (Daling 1988a). The results reported from EETD for saturate, aromatic, and polar contents were obtained using an HPLC method developed by Water Associates (Waters 1982).

Asphaltene content increases with increasing weathering (Mackay 1983a) as follows:

$$ASPH = ASPH_o / (1 - F)$$

where: ASPH is asphaltene content at F (mass fraction)
$ASPH_o$ is asphaltene content of fresh oil (mass fraction)
F is fraction of oil weathered

2.14 Wax Content

Petroleum waxes are divided into two types: paraffinic and microcrystalline. Paraffinic waxes are long chained normal alkanes with melting points in the range of 32-71°C. Typically, paraffinic waxes have between 20-40 carbon atoms and molecular weights between 300-550. Microcrystalline waxes consist mainly of iso-alkanes with 35-75 carbon atoms, melting points between 54-93°C, and molecular weights of 600-1000 (Clark 1988).

The wax content of a crude oil can be determined by the technique as described by Birdie et al.(1980). A six-fold dilution of a de-asphaltized oil is prepared with a 1:1 volume mixture of methyl ethyl-ketone and dichloromethane. The waxes are precipitated at -10°C, filtered and determined gravimetrically (Mackay 1983a, Daling 1988a).

Wax content increases with increasing weathering (Mackay 1983a) as follows:

$$WAX = WAX_o / (1 - F)$$

where: WAX is wax content at F (mass fraction)
WAX_o is wax content of fresh oil (mass fraction)
F is fraction of oil weathered

2.15 Aqueous Solubility

The solubility of oil in water can be determined by bringing to equilibrium a volume of oil and water, and then analyzing the water phase. Since oil is a complex mixture of components and each component has a different solubility in water, an oil's aqueous solubility is expressed as the cumulative concentration of the individually dissolved components. The composition and concentration of the solubilized mixture will depend upon conditions used during equilibration. The term "solubility" as applied to oils is being replaced by the technically more precise term "water soluble fraction". The values reported in this catalogue were taken from those studies where an excess of oil was used (oil-to-water volume ratios of at least 1:20) and where the processes of evaporation and oil-in-water emulsification were prevented.

Solubility is significantly reduced by weathering (Mackay 1983a) as follows:

$$S = S_o \exp(-C_{10}F)$$

where: S is solubility at F (mg/L)
S_o is solubility of fresh oil (mg/L)
C_{10} is a constant
F is fraction of oil weathered

2.16 Toxicity

Toxicity values are given as:

- LC_{50}: Median lethal concentration is the estimated concentration of a compound which will cause death to 50 percent of the test population in a specified time after exposure. In most instances, LC_{50} is statistically derived by analysis of mortalities in various test concentrations after a fixed period of exposure.

- EC_{50}: Median effective concentration is used when an effect other than death is the observed endpoint. EC_{50} is the estimated concentration of the compound in water which will have a specific effect on 50 percent of the test population in a specified time after exposure. EC_{50} values cited from Maclean (Maclean 1988) and Bobra (Bobra 1988) are the calculated concentrations that caused 50 percent of the test organisms to stop swimming (this included immobile and dead organisms).

2.17 Sulphur

The total sulphur content of oil can be determined by numerous standard techniques (ASTM D 129, ASTM D 1226, ASTM D 1552, ASTM D 2622, ASTM D 4294). The sulphur content results from EETD were obtained by using non-dispersive X-ray fluorescence spectrometry (ASTM D 1266).

2.18 Others

Colour

The observed colour of the oil is provided (ASTM D 156, ASTM D 1500, ASTM D 2392).

Fire Point

Fire point is the lowest temperature, corrected to atmospheric pressure (101.3 kPa), that the application of a test flame to the oil sample surface causes the vapour of the oil to ignite and burn for at least five seconds. It is measured by Cleveland Open-Cup and modified Pensky-Martens Apparatus. The procedure is similar to the procedure for flash point determination (ASTM D 92, IP 35).

The effect on fire point due to weathering (Mackay 1983a) is:

$$I = I_o (1 + C_9 F)$$

where: I is fire point at F (°C)
I_o is fire point of fresh oil (°C)
C_9 is a constant
F is fraction of oil weathered

Carbon Residue

Carbon residue is the carbonaceous residue formed after evaporation and pyrolysis of a petroleum product. Carbon residue can be determined by the Conradson or the Ramsbottom methods. The Conradson carbon residue method is more applicable to crude oils and heavy fuel oils. It involves destructive distillation of a weighed oil sample in a crucible. The oil sample is further heated severely for a fixed period of time while the distillation residue undergoes cracking and coking. The Conradson carbon residue is the weight percent of the carbonaceous residue left in the crucible (ASTM D 189, ASTM D 524).

Hydrogen Sulphide (H_2S)

Hydrogen sulphide content for natural gas and liquefied petroleum gases can be determined by cadmium sulphate-iodometric titration and lead acetate methods, respectively (ASTM D 2385, ASTM D 2420).

Metals

The content of many metals in petroleum can be determined by atomic absorption (ASTM D 2788, Skoog 1976).

Nickel/Vanadium Ratio

The nickel/vanadium ratio of an oil is useful in determining the source of a polluting oil (NSD 88).

Spreading

The spreading coefficient is an indication of the tendency for crude oils and oil products to spread.

The spreading coefficient is defined as:

Spreading Coefficient = $S_{WA} - S_{OA} - S_{OW}$

where: S_{WA} is water-air interfacial tension (mN/m)
S_{OA} is oil-air interfacial tension (mN/m)
S_{OW} is oil-water interfacial tension (mN/m)

Spreading to a thin slick will occur if the spreading coefficient of an oil is greater than zero, and the higher the spreading coefficient the faster the spreading will occur (Twardus 80).

Yield on Crude

Yield on crude is a routinely performed distillation procedure within the petroleum industry and is part of the procedure of analysis known as the U.S. Bureau of Mines Routine Method for the Analysis of Crude Petroleum. The distillation provides information on the yield of specific fractions obtained from a crude oil (Coleman 1978).

Compositional Analysis

Detailed compositional analysis of petroleum can be obtained through gas chromatography or gas chromatography/mass spectrometry.

ADGO CRUDE OIL

1.0 TYPE: Adgo Crude Oil

2.0 API GRAVITY (15/15°C): 16.8 (EETD 84)

3.0 DENSITY (g/mL):

TEMP (°C)			WEATHERING		
	0	2.6(vol%)	4(%)	5.4(vol%)	12(%)
0	0.9590 (EETD 84)	0.9620 (EETD 84)		0.9672 (EETD 85)	
15	0.9530 (EETD 84)	0.9600 (EETD 84)		0.9572 (EETD 85)	
20	0.9520 (ESSO 83)		0.9526 (ESSO 83)		0.9546 (ESSO 83)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	0	2.6	WEATHERING (VOL %)
0	165.0 (EETD 84)	220.0 (EETD 85)	
15	61.6 (EETD 84)	73.0 (EETD 85)	

4.2 KINEMATIC VISCOSITY (mm^2 / sec or cSt):

TEMP			WEATHERING	
(°C)	0	2.6(vol%)	4(%)	12(%)
-10	661.3 (ESSO 83)	724.5 (ESSO 83)	1302.0 (ESSO 83)	
0	172.1 (ESSO 83)	228.7 (EETD 85)	263.6 (ESSO 83)	413.8 (ESSO 83)
15	64.6 (ESSO 83)	76.0 (EETD 85)	79.08 (ESSO 83)	103.8 (ESSO 83)
25	39.83 (ESSO 83)		42.74 (ESSO 83)	53.58 (ESSO 83)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP			WEATHERING (VOL%)
(°C)	0	2.6	
0	33.3 (EETD 84)	31.5 (EETD 84)	
15	32.0 (EETD 84)	30.6 (EETD 84)	

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP			WEATHERING (VOL%)
(°C)	0	2.6	
0	16.8 (EETD 85)	16.8 (EETD 85)	
15	6.9 (EETD 84)	21.5 (EETD 85)	

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOL%) 0	2.6
0	25.9 (EETD 85)	22.6 (EETD 85)
15	24.9 (EETD 84)	22.2 (EETD 85)

6.0 POUR POINT (°C):

WEATHERING (%)	POUR POINT (°C)
0	-26 (ESSO 83)
4	-26 (ESSO 83)
12	-26 (ESSO 83)

7.0 FLASH POINT (°C):

WEATHERING (%)	FLASH POINT (°C)
0	95 (ESSO 83)
4	94 (ESSO 83)
12	126 (ESSO 83)

8.0 VAPOUR PRESSURE (kPa): N/M (EETD 84)

9.0 DISTILLATION DATA (^{o}C):

VOLUME PERCENT	WEATHERING(%) 0	4	12
INITIAL BP	159(ESSO 83)	170(ESSO 83)	205(ESSO 83)
50	329 (ESSO 83)	326(ESSO 83)	348(ESSO 83)
FINAL BP	535(ESSO 83)	542(ESSO 83)	538(ESSO 83)
FINAL VOL.	93%(ESSO 83)	96%(ESSO 83)	87%(ESSO 83)

10.0 EMULSION FORMATION TENDENCY AND STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (^{o}C)	0	WEATHERING (VOL %) 2.6	5.4
0	0.61(EETD 84)	0.72(EETD 84)	
15	0(EETD 85)	0(EETD 85)	0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (^{o}C)	0	WEATHERING (VOL %) 2.6	5.4
0	0.95(EETD 84)	0.96(EETD 84)	
15	0(EETD 85)	1.00(EETD 85)	0.79(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP		WEATHERING (VOL %)	
(°C)	0	2.6	5.4
0	71.5(EETD 84)	73.8(EETD 84)	
15	N/M(EETD 85)	77.1(EETD 85)	78.2(EETD 85)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 2012.6\ \Theta\ \exp(6.3 - 5675.3/T_k)/T_k)}{(2012.6/T_k)}$$

Where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature (Kelvin, K = °C + 273)
(EETD 84)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	61
CRX-8	39
ENER 700	59
DASIC	8(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 10(FINGAS 90a)

ADGO CRUDE OIL

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

	WEATHERING (VOLUME %) 0	2.6
SATURATES	79.8	
AROMATICS	18.8	
POLARS	0.9	
ASPHALTENES	0.5(EETD 85) 0.59(EETD 89)	0.83(EETD 89)

14.0 WAX CONTENT (WT %):

WEATHERING (VOLUME %)	WAX (WT %)
0	0.88(EETD 89)
2.6	1.42(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR (WT %)
0	0.19(EETD 86)
5.4	0.21(EETD 86)

18.0 OTHERS:

18.1 FIRE POINT (°C):

WEATHERING (%)	FIRE POINT (°C)
0	116(ESSO 83)
4	123(ESSO 83)
12	129(ESSO 83)

ALASKA NORTH SLOPE CRUDE OIL

1.0 TYPE: Alaska North Slope Crude Oil, U.S. (Ans, Sudlerochit). Trans Alaska pipeline to Valdez terminal.

2.0 API GRAVITY (15/15°C): 26.4 (AALUND 83)(NSD 88)

3.0 DENSITY (g/mL): @ 21 °C: 0.8954 (AALUND 83)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @38 °C: 42.4 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -18 (AALUND 83)(NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 24.5 (AALUND 83)(NSD 88)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.06 (AALUND 83)
1.10 (NSD 88)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 4.40 (AALUND 83)

18.2 METALS (PPM):

NICKEL:	11 (AALUND 83)
VANADIUM:	26 (AALUND 83)

18.3 NITROGEN (PPM): 2090 (AALUND 83)

18.4 H_2S (mg/m^3): 25.27 (AALUND 83)

18.0 OTHERS continued:

18.5 SALT (g/m^3) : 2.3606 (AALUND 83)

18.6 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
$C_1 - C_4$		1.17
LIGHT GASOLINE	C_5 - 65	2.20
NAPHTHA	65 - 193	15.60
DISTILLATE	193 - 343	28.60
GAS OIL	343 - 449	16.40
RESIDUE	343 +	52.40

(AALUND 83)

ALBERTA CRUDE OIL

1.0 TYPE: Alberta Crude Oil

2.0 API GRAVITY (15/15°C): 36.8 (MACKAY 82a)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (WT%) 0	10	20
0	0.8500 (MACKAY 82a)		
5	0.8460 (MACKAY 82a)		
10	0.8430 (MACKAY 82a)		
15	0.8400 (MACKAY 82a)		
20	0.8350 (MACKAY 82a)	0.8550 (MACKAY 82a)	0.8660 (MACKAY 82a)
25	0.8320 (MACKAY 82a)		
	0.8300 (MACKAY 82a)		

NOTE: DEN = 0.8500 - 0.00072T
WHERE: DEN IS THE DENSITY OF FRESH OIL AT T (g/mL)
T IS OIL TEMPERATURE (°C) (MACKAY 82a)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (WT %) 0
0	17.6 (MACKAY 82a)
5	12.4 (MACKAY 82a)
10	9.03 (MACKAY 82a)
15	6.43 (MACKAY 82a)
20	4.98 (MACKAY 82a)
25	4.22 (MACKAY 82a)

NOTE: VISC = EXP((4760/(T+273)) - 14.6)
WHERE: VISC IS VISCOSITY OF FRESH OIL AT T (mPa.s)
T IS OIL TEMPERATURE (°C) (MACKAY 82a)

4.2 KINEMATIC VISCOSITY (mm^2 / sec or cSt):

TEMP (°C)	WEATHERING (WT %) 0
0	20.7 (MACKAY 82a)
5	14.7 (MACKAY 82a)
10	10.71(MACKAY 82a)
15	7.65 (MACKAY 82a)
20	5.96 (MACKAY 82a)
25	5.08 (MACKAY 82a)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C):

WEATHERING (%)	POUR POINT (°C)
0	-24 (MACKAY 82a)
10	12 (MACKAY 82a)
20	15 (MACKAY 82a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa):

TEMP (°C)	REID VAPOUR PRESSURE (kPa)
15.6	35.7 (MACKAY 74)
63	66.9 (MACKAY 74)

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	TEMPERATURE (°C)
10	120 (MACKAY 74)
25	187 (MACKAY 74)
40	254 (MACKAY 74)

10.0 EMULSION FORMATION TENDENCY AND STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

	WEATHERING (WT %)		
	0	10	20
PARAFFINS	78.3	80.3	77.0
AROMATICS	17.6	13.0	15.2
POLARS	2.84	3.05	3.66
ASPHALTENES	1.21	3.69	4.12
	(MACKAY 82a)	(MACKAY 82a)	(MACKAY 82a)

14.0 WAX CONTENT (WT %):

WEATHERING (WT %)	WAX CONTENT (WT %)
0	6.93 (MACKAY 82a)
10	7.21 (MACKAY 82a)
20	10.9 (MACKAY 82a)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

ALBERTA SWEET MIXED BLEND CRUDE OIL

1.0 TYPE: Alberta Sweet Mixed Blend Crude Oil. EPS Standard Oil for dispersant testing.

2.0 API GRAVITY (15/15°C): 37.0 (EETD 84)

3.0 DENSITY (g/mL):

TEMP (°C)	0	WEATHERING (VOLUME %) 14.8	25.5
0	0.8470 (EETD 84)	0.8740 (EETD 84)	0.8880 (EETD 84)
15	0.8390 (EETD 84)	0.8680 (EETD 84)	0.8830 (EETD 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	0	WEATHERING (VOLUME %) 14.8	25.5
0	47.3 (EETD 85)	7500 (EETD 85)	>10000 (EETD 85)
15	9.2 (EETD 85)	43.5 (EETD 85)	48 (EETD 85)

4.2 KINEMATIC VISCOSITY (mm^2 / sec or cSt):

TEMP (°C)	0	WEATHERING (VOLUME %) 14.8	25.5
0	55.9 (EETD 85)	8581 (EETD 85)	>11000 (EETD 85)
15	11 (EETD 84)	50.1 (EETD 85)	54.4 (EETD 85)

ALBERTA SWEET MIXED BLEND CRUDE OIL

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	14.8	25.5
0	32.0 (EETD 85)	N/M (EETD 84)	N/M (EETD 84)
15	25.6 (EETD 84)	28.1 (EETD 84)	29.4 (EETD 84)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	14.8	25.5
0	17.5 (EETD 85)	N/M (EETD 84)	N/M (EETD 84)
15	8.4 (EETD 84)	8.6 (EETD 84)	15.5 (EETD 84)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	14.8	25.5
0	30.3 (EETD 85)	N/M (EETD 85)	N/M (EETD 85)
15	21.5 (EETD 84)	23.8 (EETD 84)	21.1 (EETD 84)

ALBERTA SWEET MIXED BLEND CRUDE OIL

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-8 (EETD 83)
14.8	7 (EETD 83)

7.0 FLASH POINT (°C): 7 (C.C) (EETD 84)

8.0 VAPOUR PRESSURE (kPa): 18.6 (EETD 84)

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	WEATHERING (VOL%) 0		15	
	LIQUID TEMP.	VAPOUR TEMP.	LIQUID TEMP.	VAPOUR TEMP.
IBP	115	37	171	45
5	158	95	213	125
10	182	111	235	148
15	206	126	256	153
20	234	142	276	170
25	260	155	296	193
30	286	189		
34	304	213		
	(EETD 85)	(EETD 85)	(EETD 85)	(EETD 85)

10.0 EMULSION FORMATION TENDENCY AND STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (VOLUME %) 0	14.8	25.5
0	1.0 (EETD 84)	1.0 (EETD 84)	1.0 (EETD 84)
15	0 (EETD 84)	0 (EETD 84)	1.0 (EETD 84)

ALBERTA SWEET MIXED BLEND CRUDE OIL

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0	14.8	25.5
0	1.0 (EETD 84)	1.0 (EETD 84)	1.0 (EETD 84)
15	0.2 (EETD 84)	0.2 (EETD 84)	1.0 (EETD 84)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0	14.8	25.5
0	46.7 (EETD 84)	90.0 (EETD 84)	88.9 (EETD 84)
15	N/A (EETD 84)	N/A (EETD 84)	90.0 (EETD 84)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 3839.8\ \Theta\ \exp(6.3 - 5096.4/T_k)/T_k)}{(3839.8/T_k)}$$

Where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaportion exposure
exp is exponential base e
T_k is environmental temperature (Kelvin, K = °C + 273) (EETD 84)

ALBERTA SWEET MIXED BLEND CRUDE OIL

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	33
CRX-8	45
ENER 700	51
DASIC	24(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @ 15°C (% DISPERSED): 8(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

	WEATHERING (VOLUME %)		
	0	15	25
SATURATES	84.2		
AROMATICS	12.8		
POLARS	1.2		
ASPHALTENES	1.8(EETD 86) 1.55(EETD 89)	2.49(EETD 89)	2.27(EETD 89)

14.0 WAX CONTENT (WT %):

WEATHERING (VOLUME %)	WAX (WT %)
0	1.74
14.8	1.99
24.8	1.63 (EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

IN DISTILLED WATER @22°C:	34.8 (SUNITO 86)
IN FRESH WATER @22°C:	31.2 (SUNITO 86)
IN SALT WATER @22°C:	22.0 (SUNITO 86)
IN FRESH WATER:	16.1 (MACLEAN 88)
IN SEA WATER:	13.66(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHIA MAGNA:

48 HOUR EC_{50} :	1.12 (MACLEAN 88)
	2.20 (BOBRA 88)
48 HOUR LC_{50} :	6.28 (MACLEAN 88)
	12.1 (BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

24 HOUR EC_{50} :	8.17 (MACLEAN 88)
	14.95 (BOBRA 88)
24 HOUR LC_{50} :	10.6 (MACLEAN 88)
	19.3 (BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

ACUTE TOXICITY TO FROG LARVAE (FRESHWATER):
96 HOUR LC_{50} (WATER SOLUBLE FRACTION, STATIC TEST): 250 mL/L (HEDTKE 82)
96 HOUR LC_{50} (OIL IN WATER EMULSION, STATIC TEST): 78 µL/L (HEDTKE 82)
96 HOUR LC_{50} (OIL IN WATER EMULSION, FLOW THROUGH): 28.2µL/L (HEDTKE 82)
96 HOUR LC_{50} (FLOATING OIL LAYER, STATIC TEST): 2.5µL/L (HEDTKE 82)

ACUTE TOXICITY OF OIL IN WATER EMULSION TO FATHEAD MINNOW (FRESHWATER):
96 HOUR LC_{50} (STATIC TEST): 2.5µL/L (HEDTKE 82)

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR CONTENT (WT %)
0	0.55 (EETD 86)
15	0.61 (EETD 86)
23.4	0.66 (EETD 86)

18.0 OTHERS:

AMAULIGAK CRUDE OIL

1.0 TYPE: Amauligak Crude Oil.

2.0 API GRAVITY: 27.4(15/15°C)(EETD 85)

3.0 DENSITY (g/mL): For Fv < 19.4 % & T between 0 and 15 °C:
DEN = 0.900496 + 0.000717 Fv - 0.000698 T
where: DEN is density of oil at T and Fv (g/mL)
Fv is volume percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	0	WEATHERING (VOL %) 13.4	19.4
0	0.9014(EETD 85)	0.9090(EETD 85)	0.9146(EETD 85)
15	0.8896(EETD 85)	0.8992(EETD 85)	0.9048(EETD 85)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	0	WEATHERING (VOL %) 13.4	19.4
0	25.0(EETD 85)	41.9(EETD 85)	67.5(EETD 85)
15	14.0(EETD 85)	21.0(EETD 85)	32.2(EETD 85)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	0	WEATHERING (VOL %) 13.4	19.4
0	27.7(EETD 85)	46.1(EETD 85)	73.8(EETD 85)
15	15.7(EETD 85)	23.4(EETD 85)	35.6(EETD 85)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOL %)	
	0	13.4	19.4
0	30.0(EETD 85)	31.1(EETD 85)	31.3(EETD 85)
15	29.2(EETD 85)	29.0(EETD 85)	28.5(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOL %)	
	0	13.4	19.4
0	21.1(EETD 85)	19.7(EETD 85)	17.8(EETD 85)
15	20.9(EETD 85)	15.0(EETD 85)	15.1(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOL %)	
	0	13.4	19.4
0	27.5(EETD 85)	21.6(EETD 85)	20.8(EETD 85)
15	21.5(EETD 85)	20.4(EETD 85)	19.6(EETD 85)

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	<-25(EETD 85) -66(EETD 86)
13.4	-48(EETD 86)

AMAULIGAK CRUDE OIL

7.0 FLASH POINT (°C): 0 (C.C.)(EETD 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	198	66
5	216	134
10	238	156
15	259	172
20	275	187
25	289	194
29	301	246
	(EETD 85)	(EETD 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOL %)	
	0	13.4	19.4
0	0(EETD 85)	0(EETD 85)	1.0(EETD 85)
15	0(EETD 85)	0(EETD 85)	0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (°C)		WEATHERING (VOL %)	
	0	13.4	19.4
0	0.29(EETD 85)	0.13(EETD 85)	0.78(EETD 85)
15	0(EETD 85)	0(EETD 85)	0(EETD 85)

AMAULIGAK CRUDE OIL

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOL %) 0	13.4	19.4
0	91.3(EETD 85)	92.0(EETD 85)	78.8(EETD 85)
15	N/M(EETD 85)	N/M(EETD 85)	N/M(EETD 85)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 3811\ \Theta\ \exp(6.3 - 4851/T_k)/T_k)}{(3811/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(EETD 85)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	%EFFECTIVENESS
C9527	45
CRX-8	50
ENER 700	62
DASIC	28 (FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 8(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	89.5
AROMATICS	9.3
POLARS	0.4
ASPHALTENES	0.8(EETD 86) 0.3(EETD 89)

14.0 WAX CONTENT (WT %): 0.9(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	9.6(SUNTIO 86)
in fresh water:	9.1(MACLEAN 88)
in seawater:	6.54(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

48 hour EC_{50}:	1.66(MACLEAN 88) 1.8(BOBRA 88)
48 hour LC_{50}:	6.73(MACLEAN 88) 7.2(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

24 hour EC_{50}:	6.40(MACLEAN 89) 7.54(BOBRA 88)
24 hour LC_{50}:	>6.54(MACLEAN 88) >7.7(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 0.15(EETD 86)

18.0 OTHERS:

ARABIAN CRUDE OIL

1.0 TYPE: Arabian Crude Oil.

2.0 API GRAVITY: 32.5(API 81)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.862(API 81)

4.0 VISCOSITY :

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @40°C: 10.11(API 81)
@100°C: 2.849(API 81)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -12 (WHEELER 78)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)
IBP	29
5	69
10	100
15	128
20	151
25	172
30	198
35	213
40	238
45	261
50	282
55	304
60	329
65	351
70	373
75	398
80	422
85	448
90	475
95	504
FBP	537
	(API 81)

NOTE: DATA FROM SIMULATED DISTILLATION METHOD ASTM D 2887

ARABIAN CRUDE OIL

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	17
CRX-8	9
ENER 700	22
DASIC	33(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 3(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 2.61 (EETD 89)

14.0 WAX CONTENT (WT %): 1.76 (EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.87 (API 81)

18.0 OTHERS:

18.1 NITROGEN (WT %): 0.088 (API 81)

18.2 METALS (PPM):

18.2 METALS (PPM):	NICKEL:	14 (API 81)
	VANADIUM:	3.7 (API 81)

ARABIAN HEAVY CRUDE OIL

1.0 TYPE: Arabian Heavy Crude Oil.

2.0 API GRAVITY: 27.9(AALUND 83)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOL %) 0	14.7	22.7	30.2
15.5	0.8870 (DALING 88)	0.9200 (DALING 88)	0.9350 (DALING 88)	0.9510 (DALING 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOL %) 0	14.7	22.7	30.2
6	75 (DALING 88)	386 (DALING 88)	1305 (DALING 88)	6574 (DALING 88)
13	41 (DALING 88)	241 (DALING 88)	700 (DALING 88)	2344 (DALING 88)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 21.1°C: 37.0(AALUND 83)
@ 37.8°C: 19.0(AALUND 83)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL:

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOL %) 0	14.7	22.7	30.2
13	20 (DALING 88)	16 (DALING 88)	15 (DALING 88)	16 (DALING 88)

5.3 OIL-WATER:

ARABIAN HEAVY CRUDE OIL

6.0 POUR POINT (°C):

WEATHERING (VOL %)	POUR POINT (°C)
0	-28(DALING 88) -28.9(AALUND 83) -34(WHEELER 78)
14.7	-23(DALING 88)
22.7	-18(DALING 88)
30.2	-5(DALING 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 51.71(AALUND 83)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY: WEATHERED FRACTIONS FORM STABLE EMULSIONS (DALING 88).

10.3 WATER CONTENT OF STABLE EMULSIONS (VOLUME %):

TEMP (°C)		WEATHERING (VOLUME %)	
	14.7	22.7	30.2
13	78(DALING 88)	75(DALING 88)	55(DALING 88)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

For oil weathered 30.2 % by volume:

SATURATES	23.2
AROMATICS	49.0
POLARS	18.4
ASPHALTENES	9.89(DALING 88)

ARABIAN HEAVY CRUDE OIL

13.0 HYDROCARBON GROUP ANALYSIS (WT %) continued:

		WEATHERING (VOL %)		
ASPHALTENES	0	14.7	22.7	30.2
"HARD"	4.33 (DALING 88)	4.89 (DALING 88)	5.31 (DALING 88)	5.80 (DALING 88)
"SOFT"	7.38 (DALING 88)	8.34 (DALING 88)	9.05 (DALING 88)	9.89 (DALING 88)

14.0 WAX CONTENT (WT %):

WEATHERING (VOL %)	WAX CONTENT (WT %)
0	4.62(DALING 88)
14.7	5.22(DALING 88)
22.7	5.67(DALING 88)
30.2	6.19(DALING 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.85(AALUND 83)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
LIGHT NAPHTHA	20-100	7.9
HEAVY NAPHTHA	100-150	6.8
KEROSINE	150-235	12.4
LIGHT GAS OIL	235-343	16.5
HEAVY GAS OIL	343-565	30.6
RESIDUAL OIL	565+	23.2 (AALUND 83)

ARGYL CRUDE OIL

1.0 TYPE: Argyl Crude Oil (UK North Sea).

2.0 API GRAVITY (15/15°C): 38.6 (NSD 88)

3.0 DENSITY (g/mL): 0.8320 (NSD 88)
0.8349 (AALUND 83b)

4.0 VISCOSITY :

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 15°C: 3.70 (NSD 88)
@ 40°C: 4.79 (AALUND 83b)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 9 (NSD 88)
6 (AALUND 83b)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 5.40 (NSD 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.18 (NSD 88)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
NAPHTHA	IBP-175	25.2
KEROSINE	175-260	14.9
GAS OIL	260-360	18.9
RESIDUE	360 +	40.6(AALUND 83b)

ATHABASCA BITUMEN

1.0 TYPE: Athabasca Bitumen. Syncrude Canada Ltd.
Coker feed bitumen produced by the hot water process.

2.0 API GRAVITY: 7.7 to 9.0(ARC 87)

3.0 DENSITY (g/mL): 1.006 to 1.016(ARC 87)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
15	19,000 to >700,000(ARC 87)
25	5,320 to 300,000(ARC 87)
60	3,630 to 4,350(ARC 87)
100	60 to 303(ARC 87)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 4.41 to 5.44(ARC 87)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 4.41 to 5.44(ARC 87)

18.0 OTHERS:

18.1 CARBON (WT %): 82.41 to 83.95(ARC 87)

18.2 HYDROGEN (WT %): 10.16 to 10.63(ARC 87)

18.3 NITROGEN (WT %): 0.44 to 0.92(ARC 87)

18.4 OXYGEN (WT %): 0.76 to 1.38(ARC 87)

18.5 METALS (PPM WT):	VANADIUM:	81 to 218(ARC 87)
	NICKEL:	69 to 85.2(ARC 87)

18.6 RAMSBOTTOM CARBON RESIDUE (WT %): 11.5 to 14.5(ARC 87)

18.7 ASH (WT %): 0.70 to 1.03(ARC 87)

18.8 ACID NUMBER: 1.57 to 2.58(ARC 87)

ATKINSON CRUDE OIL

1.0 TYPE: Atkinson Crude Oil.

2.0 API GRAVITY (15/15℃): 23.7(EETD 84)

3.0 DENSITY (g/mL):

TEMP (℃)	WEATHERING (%) 0	4	12	19.4(VOL %)
0	0.9219(EETD 85)			0.9476(EETD 89)
15	0.911(EETD 84)			0.9438(EETD 89)
20	0.9060(ESSO 83)	0.9172(ESSO 83)	0.9239(ESSO 83)	

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (℃)	WEATHERING (VOLUME %) 0	19.4
15	65.1(EETD 89)	533.3(EETD 89)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (℃)	WEATHERING (%) 0	4	12
-10	304.8(ESSO 83)	762.7(ESSO 83)	2506(ESSO 83)
0	136.2(ESSO 83)	317.0(ESSO 83)	783.7(ESSO 83)
15	57.28(ESSO 83)	113.6(ESSO 83)	245.0(ESSO 83)
25	34.94(ESSO 83)	62.05(ESSO 83)	124.4(ESSO 83)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	19.4
0	30.5(EETD 85)	31.2 (EETD 89)
15	28.8(EETD 85)	26.6 (EETD 89)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	19.4
0	18.7(EETD 85)	7.1 (EETD 89)
15	17.9(EETD 85)	10.9 (EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	19.4
0	24.2(EETD 85)	22.3 (EETD 89)
15	23.2(EETD 85)	21.2 (EETD 89)

6.0 POUR POINT (°C):

WEATHERING (%)	POUR POINT (°C)
0	-38(ESSO 83)
4	-35(ESSO 83)
12	-28(ESSO 83)

ATKINSON CRUDE OIL

7.0 FLASH POINT (^{o}C):

WEATHERING (%)	FLASH POINT (^{o}C)
0	10(ESSO 83)
4	32(ESSO 83)
12	75(ESSO 83)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (^{o}C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	173	58
5	210	106
10	252	123
15	290	129
17	304	201
	(EETD 85)	(EETD 85)

PERCENT CONDENSED	WEATHERING (%)		
(VOL %)	0	4	12
IBP	40(ESSO 83)	88(ESSO 83)	131(ESSO 83)
50	372(ESSO 83)	383(ESSO 83)	404(ESSO 83)
FINAL BP	555(ESSO 83)	553(ESSO 83)	556(ESSO 83)
FINAL VOL	81 %(ESSO 83)	79 %(ESSO 83)	77 %(ESSO 83)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (^{o}C)	WEATHERING (VOLUME %) 0	19.4
0	1.0 (EETD 89)	1.0 (EETD 89)
15	1.0 (EETD 89)	1.0 (EETD 89)

10.2 EMULSION STABILITY:

TEMP (^{o}C)	WEATHERING (VOLUME %) 0	19.4
0	1.0 (EETD 89)	1.0 (EETD 89)
15	1.0 (EETD 89)	1.0 (EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (^{o}C)	WEATHERING (VOLUME %) 0	19.4
0	83 (EETD 89)	53 (EETD 89)
15	88 (EETD 89)	73 (EETD 89)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 8039\,\Theta\,\exp(6.3 - 4591/T_k)/T_k)}{(8039/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature (Kelvin, K = ^{o}C + 273)
(EETD 85)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	%EFFECTIVENESS
C9527	39
CRX-8	31
ENER 700	73
DASIC	49 (FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 8(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	82.7
AROMATICS	13.2
POLARS	1.5
ASPHALTENES	2.6 (EETD 86) 2.39(EETD 89)

14.0 WAX CONTENT (WT %): 0.72(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	3.1(SUNTIO 86)
in fresh water:	2.3(MACLEAN 88)
in seawater:	2.5(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

48 hour EC_{50}:	0.61(MACLEAN 88) 0.83(BOBRA 88)
48 hour LC_{50}:	>2.27(MACLEAN 88) >3.1(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

24 hour EC_{50}:	>2.03(MACLEAN 88) >2.5(BOBRA 88)
24 hour LC_{50}:	>2.03(MACLEAN 88) >2.5(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR (WT %)
0	0.86(EETD 86)
19.4	1.07(EETD 89)

18.0 OTHERS:

18.1 FIRE POINT (°C):

WEATHERING (%)	FIRE POINT (°C)
0	26(ESSO 83)
4	50.5(ESSO 83)
12	95(ESSO 83)

AUK CRUDE OIL

1.0 TYPE: Auk Crude Oil (U.K. North Sea).

2.0 API GRAVITY: 37.5(HMSO 76)
37.15(AALUND 83b)

3.0 DENSITY (g/mL): @ 15 °C: 0.837(HMSO 76)
0.8390 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 15 °C: 3.65(HMSO 76)
@ 40 °C: 4.38(AALUND 83b)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -1 (-10)(HMSO 76)
0(AALUND 83b)

NOTE: FIGURE IN BRACKETS WAS OBTAINED FROM THE OIL INDUSTRY AND IS NOT IN AGREEMENT WITH THE PUBLISHED DATA. (HMSO 76)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 41.4(AALUND 83b)

9.0 DISTILLATION DATA:

WEIGHT PERCENT	TEMP (°C)
9.5	5 TO 100(HMSO 76)
10.6	100 TO 160(HMSO 76)
16.6	160 TO 250(HMSO 76)
18.8	250 TO 350(HMSO 76)
44.5	>350(HMSO 76)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILTY:

13.0 HYDROCARBON GROUP ANALYSIS:

AUK CRUDE OIL

14.0 WAX CONTENT (WT %): 7(HMSO 76)
6.5(AALUND 83b)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.4(HMSO 76)
0.45(AALUND 83b)

18.0 OTHERS:

18.1 H_2S EXISTENT (PPM): <1(AALUND 83b)

18.2 H_2S POTENTIAL(PPM): <1(AALUND 83b)

18.3 ACID NUMBER (mg KOH/g): 0.13(AALUND 83b)

18.4 YIELD ON CRUDE:

	RANGE, °C	VOL %	WT %
	C_1 - C4	2.2	1.5
GASOLINE	C_5 - 85	8.0	6.5
NAPHTHA	85 - 165	15.5	14.0
KEROSINE	165 - 235	13.0	12.5
GAS OIL	235 - 300	12.5	12.4
GAS OIL	300 - 350	9.4	9.6
RESIDUE	350 +	39.2	43.5

(AALUND 83b)

AVALON CRUDE OIL

1.0 TYPE: Avalon Crude Oil.

2.0 API GRAVITY(15/15°C): 36.0(EETD 84)

3.0 DENSITY (g/mL):

TEMP (°C)		WEATHERING (WT %)	
	0	9.0	20.3
0	0.851(EETD 84)	0.867(EETD 84)	0.897(EETD 84)
15	0.844(EETD 84)	0.856(EETD 84)	0.886(EETD 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)		WEATHERING (WT %)	
	0	9.0	20.3
0	575(EETD 84)	>1000(EETD 84)	>5200(EETD 84)
15	11.4(EETD 84)	83(EETD 84)	438(EETD 84)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)		WEATHERING (WT %)	
	0	9.0	20.3
0	675.7(EETD 84)	>1150(EETD 84)	>5780(EETD 84)
15	13.5(EETD 84)	97(EETD 84)	94.4(EETD 84)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (^oC)	WEATHERING (WT %) 0	9.0	20.3
0	28.0(EETD 84)	28.4(EETD 84)	N/M(EETD 84)
15	26.4(EETD 84)	25.8(EETD 84)	27.9(EETD 84)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (^oC)	WEATHERING (WT %) 0	9.0	20.3
0	25.2(EETD 84)	33.2(EETD 84)	N/M(EETD 84)
15	20.5(EETD 84)	25.6(EETD 84)	26.7(EETD 84)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (^oC)	WEATHERING (WT %) 0
0	49.4(EETD 85)
15	29.1(EETD 85)

6.0 POUR POINT (^oC):

WEATHERING (WT %)	POUR POINT (^oC)
0	12(EETD 84)
9.0	21(EETD 84)
20.3	24(EETD 84)

7.0 FLASH POINT (°C):

WEATHERING (WT %)	FLASH POINT (°C)
0	14(EETD 84)
9	33(EETD 84)
20.3	66(EETD 84)

8.0 VAPOUR PRESSURE (kPa): 63.5(EETD 84)

9.0 DISTILLATION DATA (°C):

	WEATHERING (VOL %)			
	0		15.5	
VOLUME PERCENT	LIQUID TEMP.	VAPOUR TEMP.	LIQUID TEMP.	VAPOUR TEMP.
IBP	146	44	229	122
5	189	95	259	149
10	218	118	289	171
15	248	138	(EETD 85)	(EETD 85)
20	279	158		
25	313	177		
	(EETD 85)	(EETD 85)		

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (WT %) 0	9.0	20.3
0	1.0(EETD 84)	1.0(EETD 84)	0.24(EETD 84)
15	0.16(EETD 84)	0.22(EETD 84)	1.0(EETD 84)

10.2 EMULSION STABILITY:

TEMP (^{o}C)	WEATHERING (WT %) 0	9.0	20.3
0	1.0(EETD 84)	1.0(EETD 84)	1.0(EETD 84)
15	0.37(EETD 84)	0.71(EETD 84)	1.0(EETD 84)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (^{o}C)	WEATHERING (WT %) 0	9.0	20.3
0	88(EETD 84)	87(EETD 84)	69(EETD 84)
15	89(EETD 84)	89(EETD 84)	88(EETD 84)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 5974\, \theta \exp(6.3 - 4141/T_k)/T_k)}{(5974/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = ^{o}C + 273)
(EETD 84)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

SAMPLE	DISPERSANT	% EFFECTIVENESS
AVALON J-34	C9527	11
ZONE 5	CRX-8	5
	ENER 700	11
	DASIC	16(FINGAS 90)
AVALON B-27	C9527	10
ZONE 4	CRX-8	7
	ENER 700	26
	DASIC	30(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 4(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES		83.2
AROMATICS		12.5
POLARS		1.8
ASPHALTENES		2.5 (EETD 86)
ASPHALTENES	(J-34)	2.5 (EETD 89)
	(B-27)	1.5 (EETD 89)

14.0 WAX CONTENT (WT %):

J-34	3.2 (EETD 89)
B-27	4.2 (EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (°C):

WEATHERING (WT %)	SULPHUR CONTENT (WT %)
0	0.71(EETD 86)
15.5	0.86(EETD 86)

18.0 OTHERS:

AVIATION GASOLINE 80

1.0 TYPE: Aviation Gasoline 80.
Blend of catalytically cracked and straight-run naphthas, alkylates, and isopentanes. Operational fuel for many small piston engine aircraft. Dyed red for identification. (Esso 73)

2.0 API GRAVITY: 71.8(EETD 89)

3.0 DENSITY (g/mL):

	@0°C:	0.7078 (EETD 89)
	@15°C:	0.6953 (EETD 89)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP. °C	WEATHERING (VOLUME %) 0
0	0.89(EETD 89)
15	0.83(EETD 89)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes /cm):

TEMP. °C	WEATHERING (VOLUME %) 0
0	19.7(EETD 89)
15	19.0(EETD 89)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP. °C	WEATHERING (VOLUME %) 0
0	32.1(EETD 89)
15	33.1(EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP. °C	WEATHERING (VOLUME %) 0
0	33.1(EETD 89)
15	31.7(EETD 89)

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): @ 38°C: 46.9(ESSO 73)
@ 38°C: maximum, 48(ASTM D 910)

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C) LIQUID	VAPOUR
IBP	65(EETD 89)	26(EETD 89)
10, max		75(ASTM D 910)
10	78(EETD 89)	64(EETD 89)
20	87(EETD 89)	77(EETD 89)
26		75(ESSO 73)
30	95(EETD 89)	87(EETD 89)
40, min		75(ASTM D 910)
40	101(EETD 89)	95(EETD 89)
50, max		105(ASTM D 910)
50	104(EETD 89)	101(EETD 89)
60	107(EETD 89)	105(EETD 89)
70	110(EETD 89)	108(EETD 89)
80	113(EETD 89)	111(EETD 89)
89		105(ESSO 73)
90, max		135(ASTM D 910)
90	125(EETD 89)	120(EETD 89)
95		135(ESSO 73)
FBP, max		170(ASTM D 910)
FBP		147(ESSO 73)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP. °C	WEATHERING (VOLUME %) 0
0	0(EETD 89)
15	0(EETD 89)

10.2 EMULSION STABILITY:

TEMP. °C	WEATHERING (VOLUME %) 0
0	0(EETD 89)
15	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP. °C	WEATHERING (VOLUME %) 0
0	N/M(EETD 89)
15	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):	maximum, 0.05(ASTM D 910) 0.01(ESSO 73) 0.04(EETD 89)

18.0 OTHERS:

18.1 FREEZING POINT (°C):	maximum, -58(ASTM D 910) <-71(ESSO 73)
18.2 TEL CONTENT (mL/L):	maximum, 0.13(ASTM D 910) 0.08(ESSO 73)
18.3 COLOUR:	RED(ESSO 73)(ASTM D 910)
18.4 ANTIOXIDANTS (mg/L):	maximum, 12(ASTM D 910)

AVIATION GASOLINE 100

1.0 TYPE: Aviation Gasoline 100.
Blend of catalytically cracked naphthas, alkylate, and isopentanes. Operational fuel for most commercial piston engine aircraft.
Dyed green for identification.(Esso 73)

2.0 API GRAVITY: 66.2(EETD 89)

3.0 DENSITY:

TEMP (°C)	WEATHERING (VOLUME %) 0
0	0.7277(EETD 89)
15	0.7151(EETD 89)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	1.29(EETD 89)
15	0.83(EETD 89)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP. °C	WEATHERING (VOLUME %) 0
0	20.5 (EETD 89)
15	20.0 (EETD 89)

AVIATION GASOLINE 100

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP. °C	WEATHERING (VOLUME %) 0
0	40.0 (EETD 89)
15	42.2 (EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP. °C	WEATHERING (VOLUME %) 0
0	42.5 (EETD 89)
15	42.2 (EETD 89)

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): @ 38°C: 46.9(ESSO 73)
@ 38°C: maximum, 48(ASTM D 910)

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)	
	LIQUID	VAPOUR
IBP	71(EETD 89)	25(EETD 89)
10, max		75(ASTM D 910)
10	94(EETD 89)	80(EETD 89)
20	102(EETD 89)	97(EETD 89)
22		75(ESSO 73)
30	105(EETD 89)	102(EETD 89)
40, min		75(ASTM D 910)
40	107(EETD 89)	105(EETD 89)
50, max		105(ASTM D 910)
50	108(EETD 89)	106(EETD 89)
60	109(EETD 89)	107(EETD 89)
70	111(EETD 89)	110(EETD 89)
76		105(ESSO 73)
80	114(EETD 89)	112(EETD 89)
90, max		135(ASTM D 910)
90	126(EETD 89)	119(EETD 89)
97		135(ESSO 73)
FBP, max		170(ASTM D 910)
FBP		159(ESSO 73)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP. °C	WEATHERING (VOLUME %)
	0
0	0 (EETD 89)
15	0 (EETD 89)

10.2 EMULSION STABILITY:

TEMP. °C	WEATHERING (VOLUME %)
	0
0	0 (EETD 89)
15	0 (EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP. °C	WEATHERING (VOLUME %)
	0
0	N/M (EETD 89)
15	N/M (EETD 89)

11.0 WEATHERING:	
12.0 DISPERSIBILITY:	
13.0 HYDROCARBON GROUP ANALYSIS:	
14.0 WAX CONTENT:	
15.0 AQUEOUS SOLUBILITY:	
16.0 TOXICITY:	
17.0 SULPHUR (WT %):	maximum, 0.05(ASTM D 910) 0.02(ESSO 73) 0.05(EETD 89)
18.0 OTHERS:	
18.1 FREEZING POINT (°C):	maximum, -58(ASTM D 910) <-71(ESSO 73)
18.2 TEL CONTENT (mL/L):	maximum, 1.06(ASTM D 910) 0.502(ESSO 73)
18.3 COLOUR:	GREEN(ESSO 73)(ASTM D 910)
18.4 ANTIOXIDANTS (mg/L):	maximum, 12(ASTM D 910)

AVIATION GASOLINE 100LL

1.0 TYPE: Aviation Gasoline 100LL.
Blend of catalytically cracked naphthas, alkylate, and isopentanes. Operational fuel for most commercial piston engine aircraft. Similar to grade 100 except with lower lead-additive content. Dyed blue for identification (ASTM D 910).

2.0 API GRAVITY:

3.0 DENSITY:

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): @ 38°C: maximum, 48(ASTM D 910)

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C)
10, max	75(ASTM D 910)
40, min	75(ASTM D 910)
50, max	105(ASTM D 910)
90, max	135(ASTM D 910)
FBP, max	170(ASTM D 910)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): maximum, 0.05(ASTM D 910)

18.0 OTHERS:

18.1 FREEZING POINT (°C): maximum, -58(ASTM D 910)

18.2 TEL CONTENT (mL/L): maximum, 0.53(ASTM D 910)

18.3 COLOUR: BLUE(ASTM D 910)

18.4 ANTIOXIDANTS (mg/L): maximum, 12(ASTM D 910)

AVIATION GASOLINE 115

1.0 TYPE: Aviation Gasoline 115.
Blend of high-octane, quality hydrocarbon components.
Operational fuel for most military piston engine
aircraft. Dyed purple for identification.(Esso 73)

2.0 API GRAVITY:

3.0 DENSITY:

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): @ 38°C: 46.9(ESSO 73)

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C)
21	75
62	105
96	135
FBP	161(ESSO 73)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

AVIATION GASOLINE 115

17.0 SULPHUR (WT %): 0.02(ESSO 73)

18.0 OTHERS:

18.1 FREEZING POINT (°C):	<-71(ESSO 73)
18.2 TEL CONTENT (mL/L):	maximum, 1.215(ESSO 73) 1.19(ESSO 73)
18.3 COLOUR:	PURPLE(ESSO 73)

BCF 24 CRUDE OIL

1.0 TYPE: BCF 24 Crude Oil (Venezuela). La Salina, Lake Maracaibo.

2.0 API GRAVITY (15/15°C): 23.5 (NSD 88)

3.0 DENSITY (g/mL): 0.9130 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 41.40 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -51.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 3.85 (NSD 88)

18.0 OTHERS:

BEATRICE CRUDE OIL

1.0 TYPE: Beatrice Crude Oil (UK, North Sea).

2.0 API GRAVITY (15/15°C): 38.7 (AALUND 83b)

3.0 DENSITY:

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @40°C: 6.85 (AALUND 83b)
@50°C: 5.15 (AALUND 83b)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 13 (AALUND 83b)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 38.6 (AALUND 83b)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.05(AALUND 83b)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE,°C	VOLUME %
C_1-C_5		3.77
LIGHT NAPHTHA	20-70	3.6
NAPHTHA	70-100	3.5
HEAVY NAPHTHA	100-150	7.3
KEROSINE	150-205	8.8
MIDDLE DISTILLATE	205-343	25.8
GAS OIL	343-565	34.7
RESIDUE	565+	14.4

(AALUND 83b)

BENT HORN A-O2 CRUDE OIL

1.0 TYPE: Bent Horn Crude Oil. Data for EETD 1985 from drill stemp testing sample of A-02 well, 1985.

2.0 API GRAVITY: 42(OILWEEK 85)

3.0 DENSITY (g/mL): For Fv < 32.9% & T between -43 and 18 °C:
DEN = 0.829837 + 0.001326 Fv - 0.000627 T
where: DEN is density of oil at T and Fv (g/mL)
Fv is volume percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	WEATHERING (VOL %) 0	20.4	32.9
-43	0.852(CHARLES 84)		
-15	0.845(CHARLES 84)		
0	0.8299(EETD 85) 0.833(CHARLES 84)	0.8600(EETD 85)	0.8735(EETD 85)
15	0.8177(EETD 85) 0.821(CHARLES 84)	0.8484(EETD 85)	0.8615(EETD 85)
18	0.815(CHARLES 84)		

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

VISC = EXP (4278 / (T + 273) - 12.32) (CHARLES 84)
where: VISC is dynamic viscosity (mPa.s) of fresh oil at T
T is oil temperature (°C)
EXP is exponential base e

TEMP (°C)	WEATHERING (VOLUME %) 0	20.4	32.9
-43	44000(CHARLES 84)		
-30	17430(CHARLES 84)		
-20	580(CHARLES 84)		
-10	207(CHARLES 84)		
0	68(CHARLES 84) 25.0(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	12.1(EETD 85)	100(EETD 85)	525(EETD 85)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (^oC)	0	WEATHERING (VOLUME %) 20.4	32.9
0	27.4(EETD 85)	31.1(EETD 85)	N/M(EETD 85)
15	25.4(EETD 85)	27.9(EETD 85)	28.7(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (^oC)	0	WEATHERING (VOLUME %) 20.4	32.9
0	34.4(EETD 85)	26.7(EETD 85)	N/M(EETD 85)
15	17.6(EETD 85)	1.7(EETD 85)	2.3(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (^oC)	0	WEATHERING (VOLUME %) 20.4	32.9
0	30.0(EETD 85)	38.9(EETD 85)	N/M(EETD 85)
15	26.6(EETD 85)	13.8(EETD 85)	11.4(EETD 85)

BENT HORN A-O2 CRUDE OIL

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-16(EETD 85) -18 TO 21(OILWEEK 85)
20.4	-2(EETD 85)
32.9	11(EETD 85)

7.0 FLASH POINT (°C): -14 (C.C.)(EETD 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	133	33
5	158	92
10	180	113
15	203	130
20	228	149
25	253	169
30	279	188
35	303	206
	(EETD 85)	(EETD 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	20.4	32.9
0	0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)
15	0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)

10.2 EMULSION STABILITY:

TEMP		WEATHERING (VOLUME %)	
(°C)	0	20.4	32.9
0	0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)
15	0(EETD 85)	0.54(EETD 85)	1.0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP		WEATHERING (VOLUME %)	
(°C)	0	20.4	32.9
0	N/M(EETD 85)	53.8(EETD 85)	77.3(EETD 85)
15	N/M(EETD 85)	47.6(EETD 85)	86.0(EETD 85)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 4985\ \Theta\ \exp(6.3 - 4182/T_k)/T_k)}{(4985/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature (Kelvin, K = °C + 273)
(EETD 85)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	17
CRX-8	20
ENER 700	23
DASIC	35(FINGAS 90)

BENT HORN A-02 CRUDE OIL

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 6(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	95.0
AROMATICS	4.3
POLARS	0.3
ASPHALTENES	0.4(EETD 86)

14.0 WAX CONTENT (WT %): 1.8(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR CONTENT (WT %)
0	0.76(EETD 86)
20.4	0.81(EETD 86)
32.9	0.89(EETD 86)

18.0 OTHERS:

18.1 COMPOSITIONAL ANALYSIS:

COMPONENT	MOLE %
N_2	0.16
CO_2	0.15
H_2S	0.03
C_1	7.12
C_2	2.75
C_3	2.85
iC_4	1.30
C_4	3.21
iC_5	2.28
C_5	2.91
C_6	5.74
C_7	6.00
C_8	6.95
C_9	5.49
C_{10}	5.49
C_{11}	4.80
C_{12}	3.78
C_{13}	3.98
C_{14}	3.58
C_{15}	2.65
C_{16}	2.24
C_{17}	2.25
C_{18}	1.91
C_{19}	1.53
C_{20}	1.39
C_{21}	1.16
C_{22}	1.08
C_{23}	0.97
C_{24}	0.82
C_{25}	0.79
C_{26}	0.68
C_{27}	0.65
C_{28}	0.63
C_{29}	0.54
C_{30+}	5.83

18.1 COMPOSITIONAL ANALYSIS (continued):

COMPONENT	MOLE %
AROMATICS:	
C_6H_6	0.08
C_7H_8	0.29
C_8H_{10}	0.74
C_8H_{10}	0.91
C_9H_{12}	0.45
NAPHTHENES:	
C_5H_{10}	0.36
C_6H_{12}	0.60
C_6H_{12}	0.64
C_7H_{14}	2.14

(PANARTIC 84)

BENT HORN CRUDE OIL

1.0 TYPE: Bent Horn Crude Oil.
Data for sample taken from the Imperial Bedford tanker on September 10, 1985 at the Port of Montreal.

2.0 API GRAVITY(15/15°C): 41.3(EETD 85)

3.0 DENSITY (g/mL): For Fv < 33.3% & T between 0 and 15 °C:
DEN = 0.830471 + 0.001329 Fv - 0.000784 T
where: DEN is density of oil at T and Fv (g/mL)
Fv is volume percent of oil weathered
T is oil temperature (°C)

TEMP (°C)		WEATHERING (VOLUME %)	
	0	20.2	33.3
0	0.8298(EETD 85)	0.8589(EETD 85)	0.8738(EETD 85)
15	0.8181(EETD 85)	0.8472(EETD 85)	0.8619(EETD 85)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	20.2	33.3
0	53.8(EETD 85)	14750(EETD 85)	110000(EETD 85)
15	24.0(EETD 85)	60.0(EETD 85)	5820(EETD 85)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (^oC)	0	WEATHERING (VOLUME %) 20.2	33.3
0	27.7(EETD 85)	33.1(EETD 85)	N/M(EETD 85)
15	26.2(EETD 85)	28.2(EETD 85)	25.0(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (^oC)	0	WEATHERING (VOLUME %) 20.2	33.3
0	53.5(EETD 85)	32.1(EETD 85)	N/M(EETD 85)
15	38.5(EETD 85)	2.2(EETD 85)	7.4(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (^oC)	0	WEATHERING (VOLUME %) 20.2	33.3
0	48.0(EETD 85)	42.3(EETD 85)	N/M(EETD 85)
15	39.1(EETD 85)	16.6(EETD 85)	15.4(EETD 85)

6.0 POUR POINT (^oC):

WEATHERING (VOLUME %)	POUR POINT (^oC)
0	-18(EETD 85)
20.2	-7(EETD 85)
33.3	8(EETD 85)

7.0 FLASH POINT (^oC): -9 (C.C)(EETD 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (^oC):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	111	33
5	164	89
10	187	110
15	210	130
20	235	147
25	259	174
30	284	188
34	305	203
	(EETD 85)	(EETD 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

		WEATHERING (VOLUME %)	
TEMP (^oC)	0	20.2	33.3
0	0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)
15	0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)

BENT HORN CRUDE OIL

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0	20.2	33.3
0	0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)
15	0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0	20.2	33.3
0	N/M(EETD 85)	59.6(EETD 85)	66.0(EETD 85)
15	N/M(EETD 85)	13.6(EETD 85)	44.4(EETD 85)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 4944\ \theta\ \exp(6.3 - 4254/T_k)/T_k)}{(4944/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature (Kelvin, K = °C + 273)
(EETD 85)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	17
CRX-8	20
ENER 700	23
DASIC	35(FINGAS 90)

BENT HORN CRUDE OIL

12.2 NATURAL DISPERSIBILITY @ 15°C (% DISPERSED) :

WEATHERING (VOLUME %)	% DISPERSED
0	6(FINGAS 90a)
20.4	5(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

	WEATHERING (VOLUME %)	
	0	20.4
SATURATES	94.3	
AROMATICS	4.8	
POLARS	0.3	
ASPHALTENES	0.6 (EETD 86) 0.4 (EETD 89)	0.33 (EETD 89)

14.0 WAX CONTENT (WT %):

WEATHERING (VOLUME %)	WAX CONTENT (WT %)
0	2.11(EETD 89)
20.4	1.65(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	7.6(SUNTIO 86)
in fresh water:	6.4(MACLEAN 88)
in salt water @ 22°C:	6.0(SUNTIO 86)
in seawater:	5.34(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHIA MAGNA:
48 hour EC_{50}: 1.07(MACLEAN 88)
1.3(BOBRA 88)
48 hour LC_{50}: 1.75(MACLEAN 88)
2.1(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:
48 hour EC_{50}: 3.39(MACLEAN 88)
3.87(BOBRA 88)
48 hour LC_{50}: 4.49(MACLEAN 88)
5.1(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 0.82(EETD 86)

18.0 OTHERS:

BERYL CRUDE OIL

1.0 TYPE: Beryl Crude Oil (UK, North Sea).

2.0 API GRAVITY (15/15°C): 39.6 (NSD 88)
36.5 (AALUND 83b)

3.0 DENSITY (g/mL): 0.8270 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @15°C: 9.47 (AALUND 83b)
@38°C: 2.90 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -54.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 35.9 (AALUND 83b)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 5.10 (NSD 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.36 (NSD 88)
0.42 (AALUND 83b)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 4.40 (NSD 88)

18.2 YIELD ON CRUDE:

	RANGE,°C	VOLUME %
<C_5		3.77
NAPHTHA	15.5-49	2.29
NAPHTHA	49-165	21.89
KEROSINE	165-218	10.7
LIGHT GAS OIL	218-343	24.75
HEAVY GAS OIL	343-535	25.89
RESIDUE	535+	12.95(AALUND 83b)

BOW RIVER BLENDED CRUDE OIL

1.0 TYPE: Bow River Blended Crude Oil.

2.0 API GRAVITY: 26.7(AALUND 83a)

3.0 DENSITY (g/mL): DEN = 0.901 - 0.000617 T
WHERE: DEN IS THE DENSITY OF FRESH OIL AT T (mPa.s)
T IS OIL TEMPERATURE (°C) (MACKAY 82a)

TEMP (°C)		WEATHERING (WEIGHT %)	
	0	10	20
0	0.900(MACKAY 82a)		
5	0.899(MACKAY 82a)		
10	0.896(MACKAY 82a)		
15	0.893(MACKAY 82a)		
15.5	0.8936(AALUND 83a)		
20	0.889(MACKAY 82a)		
25	0.885(MACKAY 82a)		
ROOM TEMP.	0.90(TWARDUS 80)	0.923(MACKAY 82a)	0.938(MACKAY 82a)

BOW RIVER BLENDED CRUDE OIL

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

VISC = EXP((4310/(T+273))-11.4)
WHERE: VISC IS VISCOSITY OF FRESH OIL AT T (mPa.s)
T IS TEMP (°C) (MACKAY 82a)

TEMP (°C)	WEATHERING (%) 0
0	88.4(MACKAY 82a) 74(TWARDUS 80)
5	62.0(MACKAY 82a)
10	45.1(MACKAY 82a) 67(TWARDUS 80)
15	33.7 (MACKAY 82a)
20	28.3(MACKAY 82a) 42.5(TWARDUS 80)
25	23.7(MACKAY 82a)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	98.2(MACKAY 82a)
5	69.0(MACKAY 82a)
10	50.3(MACKAY 82a)
15	37.7(MACKAY 82a)
20	31.8(MACKAY 82a)
25	26.8(MACKAY 82a)
40	18.30(AALUND 83a)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm): @ ROOM TEMP: 15(TWARDUS 80)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

WEATHERING (WT %)	INTERFACIAL TENSION (mN/m or dynes/cm)
0	26.8(MACKAY 82a)
10	23.9(MACKAY 82a)
20	27.8(MACKAY 82a)

5.3 OIL-WATER (mN/m or dynes/cm): @ ROOM TEMP: 28.85(TWARDUS 80)

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	-39(MACKAY 82a) -27(TWARDUS 80) -50.0(AALUND 83a)
10	-15(MACKAY 82a)
20	-3(MACKAY 82a)

7.0 FLASH POINT (°C): <12(O.C.)(TWARDUS 80)

8.0 VAPOUR PRESSURE (kPa): 37.2(AALUND 83a)

BOW RIVER BLENDED CRUDE OIL

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	TEMP (°C)
0	46
10	115
20	185
30	265
40	310
50	350
60	370
70	385
80	390(TWARDUS 80)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILTY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

GROUP	0	WEATHERING (WT %) 10	20
PARAFFINS	69.6	66.7	62.5
AROMATICS	21.4	22.4	25.8
POLARS	3.96	3.36	3.87
ASPHALTENES	5.04	7.50	7.80

(MACKAY 82a)

14.0 WAX CONTENT (WT %):

WEATHERING (WT %)	WAX (WT %)
0	2.75(MACKAY 82a)
10	6.47(MACKAY 82a)
20	8.63(MACKAY 82a)

BOW RIVER BLENDED CRUDE OIL

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (PPM): 21,000(AALUND 83a)

18.0 OTHERS:

18.1 FIRE POINT (°C): 22(TWARDUS 80)

18.2 IN-SITU COMBUSTION RESULTS : FRESH OIL IGNITED EASILY, RESIDUE 6.1 VOL% (TWARDUS 80)

18.3 CON. CARBON (WT %): 6.7(AALUND 83a)

18.4 METALS (PPM):

NICKEL:	20.7(AALUND 83a)
VANADIUM:	54.0(AALUND 83a)

18.5 YIELD ON CRUDE:

	RANGE, °C	VOL %
NAPHTHA	C_5-190	20.40
KEROSINE	190-277	13.10
DISTILLATE	277-343	10.80
GAS OIL	343-565	32.50
RESIDUE	565+	23.20

(AALUND 83a)

BOW RIVER HEAVY CRUDE OIL

1.0 TYPE: Bow River Heavy Crude Oil (Alberta, Canada)

2.0 API GRAVITY (15/15°C): 26.7 (NSD 88)

3.0 DENSITY (g/mL): 0.8940 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 18.3 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -50 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.10 (NSD 88)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 0.38 (NSD 88)

BRAE CRUDE OIL

1.0 TYPE: Brae Crude Oil (UK North Sea)

2.0 API GRAVITY (15/15°C): 33.6 (AALUND 83b)

3.0 DENSITY:

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 10°C: 13.6 (AALUND 83b)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -6.0 (AALUND 83b)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.35 (AALUND 83b)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.73 (AALUND 83b)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1-C_4		2.15 (WT %)
NAPHTHA	C_5-149	21.45
KEROSINE	149-232	15.2
GAS OIL	232-342	21.3
RESIDUE	342+	39.3(AALUND 83b)

BRENT BLEND CRUDE OIL

1.0 TYPE: Brent Blend Crude Oil (UK North Sea). Contributors in early 1983 included North and South Cormorant, Brent, Dunlin, Thistle, and Murchison (Aalund 83b).Collected at South Cormorant platform and transferred by pipeline to Sullom Voe, Shetland Islands (Corbett 90a).

2.0 API GRAVITY (15/15°C): 38.0 (AALUND 83b)
37.88(CORBETT 90a)

3.0 DENSITY:

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 20°C: 5.67 (AALUND 83b)
@ 20°C: 6.14(CORBETT 90a)
@37.8°C: 3.64 (AALUND 83b)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -15 (AALUND 83b)
-9 (CORBETT 90a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.26 (AALUND 83b)

14.0 WAX CONTENT (WT %): 5.2(AALUND 83b)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.38 (AALUND 83b)
0.37 (CORBETT 90a)

18.0 OTHERS:

18.1 METALS (ppm):	VANADIUM:	3.8(AALUND 83b) 6(CORBETT 90a)
	NICKEL:	0.80(AALUND 83b) <2(CORBETT 90a)
	IRON:	0.10 (AALUND 83b)
	SODIUM:	6(CORBETT 90a)

18.2 TOTAL ACID NO.(mg KOH/g): 0.06(CORBETT 90a)

18.3 SALT AS NaCl (PPM): 24(CORBETT 90a)

18.4 CON. CARBON (WT %): 2(CORBETT 90a)

18.5 YIELD ON CRUDE:

	RANGE, °C	WEIGHT %	VOLUME %
NAPHTHA	C_5-165	21.67	24.5(AALUND 83b) 24.64(CORBETT 90a)
HEAVY NAPHTHA	165-190	4.19	4.42(CORBETT 90a)
GAS OIL	190-250	10.11	10.3(CORBETT 90a)
GAS OIL	250-310	11.57	11.42(CORBETT 90a)
GAS OIL	310-375	11.49	11.04(CORBETT 90a)
HEAVY GAS OIL	375-420	5.03	4.73(CORBETT 90a)
HEAVY GAS OIL	420-525	17.7	16.22(CORBETT 90a)
RESIDUUM	525+	15.47	13.09(CORBETT 90a)

BRENT CRUDE OIL

1.0 TYPE: Brent Crude Oil (UK North Sea). This key UK crude is produced pure and is a major component of Brent Blend (Aalund 83b). Aalund 83b results are assay of unblended Brent crude loaded at offshore SPAR (Aalund 83b).

2.0 API GRAVITY (15/15°C): 38.2 (NSD 88)

3.0 DENSITY (g/mL): 0.8340 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40°C: 3.70 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -3.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 6.50 (NSD 86)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.26 (NSD 88)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 2.67 (NSD 88)

18.2 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1-C_4		3.2
GASOLINE	C_5-85	7.5
NAPHTHA	85-165	17.7
KEROSINE	165-235	13.5
GAS OIL	235-300	12.9
GAS OIL	300-350	9.2
RESIDUE	350+	36.5

(AALUND 83b)

BUCHAN CRUDE OIL

1.0 TYPE: Buchan Crude Oil (UK, North Sea).

2.0 API GRAVITY (15/15°C): 33.5 (NSD 88)
33.7 (AALUND 83b)

3.0 DENSITY (g/mL): 0.8580 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 20°C: 11.8 (NSD 88)
@ 20°C: 20.37(AALUND 83b)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 6.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 2.70 (NSD 88)

14.0 WAX CONTENT (WT %): 4.10 (NSD 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.81 (NSD 88)
0.84 (AALUND 83b)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 5.78 (NSD 88)

18.2 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1-C_4		1.5 (WT %)
GASOLINE	C_5-149	19.9
KEROSINE	149-232	14.45
GAS OIL	232-342	20.55
RESIDUE	342+	43.25

(AALUND 83b)

BUNKER C FUEL OIL

1.0 TYPE: Bunker C Fuel Oil or Fuel Oil Number 6.

2.0 API GRAVITY:
14.1(API 81)
10(FINGAS 79)
7.3(PANCIROV 74)
15.5(YUEN 70)
12.3(EETD 88)

3.0 DENSITY (g/mL): For T between 0 and 30 °C:
DEN = 0.97871 - 0.000710 T
where: DEN is density of fresh oil at T (g/mL)
T is oil temperature (°C)

TEMP (°C)	WEATHERING (%)
	0
0	0.986(EETD 84) 0.980(MACKAY 82a) 0.969 TO 0.981(CURL 77) 0.9941(EETD 88)
5	0.976(MACKAY 82a) 0.9904(EETD 88)
10	0.973(MACKAY 82a) 0.963 TO 0.975(CURL 77) 0.9867(EETD 88)
15	0.974(EETD 84) 0.969(MACKAY 82a) 0.9830(EETD 88)
15.6	0.9710(API 81) 0.963(YUEN 70) 0.959 TO 0.972(CURL 77)
20	0.966(MACKAY 82a) 0.956 TO 0.970(CURL 77) 0.9788(EETD 88)
25	0.964(MACKAY 82a) 0.9749(EETD 88)
30	0.950 TO 0.964(CURL 77) 0.9718(EETD 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	73,500,000(TWARDUS 80) 1,400,000(EETD 88)
10	28,700,000(TWARDUS 80)
15	48,000(EETD 88)
20	5,980,000(TWARDUS 80)
25	3,180(MACKAY 82a)
50	545(YUEN 70)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
10	>1000(CURL 77)
20	>500(CURL 77)
40	>130(CURL 77)
55	90 TO 2000(CURL 77)
60	65 TO 1000(CURL 77)
70	65 TO 360(CURL 77)
80	65 TO 180(CURL 77)

NOTE: DATA OBTAINED FROM A GRAPH

BUNKER C FUEL OIL

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (^{o}C)	WEATHERING (%) 0
0	N/M(EETD 88)
15	N/M(EETD 88)
ROOM TEMP	27(TWARDUS 80)

5.2 OIL-SEAWATER (mN/m or dynes/cm): N/M(EETD 88)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (^{o}C)	WEATHERING (%) 0
0	N/M(EETD 88)
15	N/M(EETD 88)
ROOM TEMP	39.82(TWARDUS 80)

6.0 POUR POINT (^{o}C):	6(MACKAY 82a) 7(TWARDUS 80) 2(FINGAS 79) <16(CURL 77) -1(YUEN 70) 15(EETD 88)
7.0 FLASH POINT (^{o}C):	>110(C.C.)(EETD 84) 66(OHMTADS 81) 60 MIN,(ASTM D 396) 174(O.C.)(TWARDUS 80) 80(FINGAS 79) >66(CURL 77) 99(YUEN 70) 98(EETD 88)

8.0 VAPOUR PRESSURE:

BUNKER C FUEL OIL

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	324(EETD 88)	115(TWARDUS 80) 151(API 81) 78(EETD 88)
5	391(EETD 88)	222(API 81) 126(EETD 88)
10	414(EETD 88)	310(TWARDUS 80) 248(API 81) 166(EETD 88)
15	422(EETD 88)	259(API 81) 199(EETD 88)
20	427(EETD 88)	335(TWARDUS 80) 267(API 81) 217(EETD 88)
25	428(EETD 88)	272(API 81) 225(EETD 88)
30	432(EETD 88)	345(TWARDUS 80) 277(API 81) 231(EETD 88)
35	435(EETD 88)	282(API 81) 233(EETD 88)
40	438(EETD 88)	350(TWARDUS 80) 286(API 81) 234(EETD 88)
45	440(EETD 88)	293(API 81) 235(EETD 88)
50	441(EETD 88)	355(TWARDUS 80) 299(API 81) 235(EETD 88)
55	445(EETD 88)	304(API 81) 235(EETD 88)
60	448(EETD 88)	367(TWARDUS 80) 312(API 81) 235(EETD 88)
65	449(EETD 88)	318(API 81) 235(EETD 88)
70		370(TWARDUS 80) 326(API 81)
75		375(TWARDUS 80) 333(API 81)
80		344(API 81)
85		357(API 81)
90		387(API 81)
95		417(API 81)
FBP		441(API 81)

NOTE: (API 81) DATA FROM SIMULATED DISTILLATION METHOD ASTM D 2887

10.0 EMULSION FORMATION TENDENCY & STABILITY:

BUNKER C FROM THE ARROW INCIDENT FORMED STABLE EMULSIONS (YUEN 70)

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%)
	0
0	0.1(EETD 84) 0(EETD 88)
15	0(EETD 84) 0(EETD 88)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%)
	0
0	0.2(EETD 84) 0(EETD 88)
15	0.1(EETD 84) 0(EETD 88)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%)
	0
0	N/M(EETD 84)
15	N/M(EETD 84)

11.0 WEATHERING:

BUNKER C FUEL OIL

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	1
CRX-8	2
ENER 700	1
DASIC	2(FINGAS 90)

12.2 NATURAL DISPERSIBLITY @15°C (% DISPERSED): 0(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

HYDROCARBON GROUP	WT %
SATURATES	21.1(PANCIROV 74)(ASTM D 2007) 20.98(WATERS 82) 15(CURL 77) 24.4(MACKAY 82a) 21.1(CLARK 77)
AROMATICS	34.2(PANCIROV 74)(ASTM D 2007) 33.83(WATERS 82) 25(CURL 77) 54.6(MACKAY 82a) 34.2(CLARK 77)
POLARS	30.3(PANCIROV 74)(ASTM D 2007) 7.39(WATERS 82) 15(CURL 77) 14.9(MACKAY 82a) 30.3(CLARK 77)
ASPHALTENES	14.4(PANCIROV 74)(ASTM D 2007) 6.17(MACKAY 82a) 9.28(YUEN 70) 14.4(CLARK 77) 6.73(EETD 89)
NAPHTHENES	45(CURL 77)

14.0 WAX CONTENT (WT %): 1.23(EETD 89)
55.4(MACKAY 82a)

15.0 AQUEOUS SOLUBILITY (mg/L):

in 32 $^{o}/_{oo}$ seawater @ 20°C:	6.3(ANDERSON 74)
in distilled water:	1.7(MURRAY 84)
in distilled water @ 22°C:	0.4(SUNTIO 86)
in freshwater:	4.45(MACLEAN 88)
in seawater:	2.29(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

48 hour EC_{50} :	0.37(BOBRA 88) 4.14(MACLEAN 88)
48 hour LC_{50} :	>0.4(BOBRA 88) >4.45(MACLEAN 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

48 hour EC_{50} :	>0.32(BOBRA 88) >2.29(MACLEAN 88)
48 hour LC_{50} :	>0.32(BOBRA 88) >2.29(MACLEAN 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

ACUTE TOXICITY OF WATER SOLUBLE FRACTIONS (PPM):

SPECIES	24 hour LC_{50}	48 hour LC_{50}	96 hour LC_{50}
POLYCHAETA:			
NEANTHES ARENACEODENTATA	>6.3(ROSSI 76)	4.6(ROSSI 76)	3.6(ROSSI 76)
CAPITAELLA CAPITATA	>6.3(ROSSI 76)	1.1(ROSSI 76)	0.9(ROSSI 76)
CRUSTACEA:			
MYSIDOPSIS ALMYRA	6.3(ANDERSON 74)	0.9(ANDERSON 74)	
PALAEMONETES PUGIO	3.2(ANDERSON 74)	2.8(ANDERSON 74)	2.6(ANDERSON 74)
PENAEUS AZTECUS	3.8(ANDERSON 74)	3.5(ANDERSON 74)	1.9(ANDERSON 74)
FISH:			
MENIDIA BERYLLINA	3.6(ANDERSON 74)	2.7(ANDERSON 74)	1.9(ANDERSON 74)
FUNDULUS SIMILIS	3.8(ANDERSON 74)	2.3(ANDERSON 74)	1.7(ANDERSON 74)
CYPRINODON VARIEGATUS	4.7(ANDERSON 74)	4.4(ANDERSON 74)	3.1(ANDERSON 74)

COMBUSTION PRODUCTS: NO GREAT HAZARD(OHMTADS 81)
POTENTIAL FOR ACCUMULATION: NEGATIVE(OHMTADS 81)

17.0 SULPHUR (WT %):

2.40(API 81)
1.46(PANCIROV 74)
2.24(YUEN 70)
1.5(EETD 88)

18.0 OTHERS:

18.1 IN-SITU COMBUSTION OF FRESH OIL: RELATIVELY LONG IGNITION TIME (1.9 MIN)
26.4 VOL % RESIDUE (TWARDUS 80)

18.2 AUTO IGNITION POINT (°C): 408(OHMTADS 81) 407(CURL 77)

18.3 BOILING POINT (°C): 400(OHMTADS 81)

18.4 TOTAL ASH CONTENT (WT %): 0.08(YUEN 70)

18.5 NITROGEN CONTENT (WT %): 0.34(API 81) 0.94(PANCIROV 74)

18.6 FIRE POINT (°C): >257(TWARDUS 80) 164(YUEN 70)

18.7 INITIAL BOILING POINT (°C): 180 TO 500(FINGAS 79)

18.8 CARBON RESIDUE (WT %): 12.00(YUEN 70)

18.9 METALS (PPM):	NICKEL:	62(API 81) 89(PANCIROV 74) 35(YUEN 70)
	VANADIUM:	25 TO 26(API 81) 73(PANCIROV 74) 272(YUEN 70)

18.10 COMPOSITIONAL ANALYSIS (WT %):

SATURATES:	
N-ALKANES C_{13}+	1.73
ISOALKANES	5.0
1-RING CYCLOALKANES	3.9
2-RING CYCLOALKANES	3.4
3-RING CYCLOALKANES	2.9
4-RING CYCLOALKANES	2.7
5-RING CYCLOALKANES	1.9
6-RING CYCLOALKANES	0.4
AROMATICS:	
BENZENES	1.9
INDANS & TETRALINS	2.1
DINAPHTHENO BENZENES	2.0
METHYLNAPHTHALENES	2.6
ACENAPHTHENES	3.1
ACENAPHTHALENES	7.0
PHENANTHRENES	11.6
PYRENES	1.7
BENZOTHIOPHENES	1.5
DIBENZOTHIOPHENES	0.7(CLARK 77)

CALIFORNIA CRUDE OIL (API GRAVITY:11)

1.0 TYPE: California Crude Oil (API Gravity: 11).

2.0 API GRAVITY (15/15°C): 10.3(EETD 88)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.9968(EETD 88)
5	0.9942(EETD 88)
10	0.9915(EETD 88)
15	0.9882(EETD 88)
20	0.9852(EETD 88)
25	0.9824(EETD 88)
30	0.9796(EETD 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	220,000(EETD 88)
15	34,000(EETD 88)

CALIFORNIA CRUDE OIL (API GRAVITY:11)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 88)
15	37.0(EETD 88)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 88)
15	N/M(EETD 88)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 88)
15	N/M(EETD 88)

6.0 POUR POINT (°C): 0(EETD 88)

7.0 FLASH POINT (°C): 28(C.C)(EETD 88)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA: Sample contained approximately 6% water; distillation could not be properly performed.(EETD 88)

CALIFORNIA CRUDE OIL (API GRAVITY:11)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 88)
15	0(EETD 88)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 88)
15	0(EETD 88)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 88)
15	N/M(EETD 88)

11.0 WEATHERING:

CALIFORNIA CRUDE OIL (API GRAVITY:11)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	1
CRX-8	1
ENER 700	1
DASIC	1 (FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 0 (FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	13.7
AROMATICS	29.8
POLARS	31.4
ASPHALTENES	24.8(MACKAY 88) 18.6(EETD 89)

14.0 WAX CONTENT (WT %): 2.4(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in double distilled water @ 22°C:	11.33(MACKAY 88)
in salt water @ 22°C:	9.74(MACKAY 88)

16.0 TOXICITY:

17.0 SULPHUR (WT %): 3.3(EETD 88)

18.0 OTHERS:

CALIFORNIA CRUDE OIL (API GRAVITY:15)

1.0 TYPE: California Crude Oil (API Gravity: 15).

2.0 API GRAVITY (15/15°C): 13.2(EETD 88)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.9907(EETD 88)
5	0.9832(EETD 88)
10	0.9802(EETD 88)
15	0.9770(EETD 88)
20	0.9735(EETD 88)
25	0.9702(EETD 88)
30	0.9672(EETD 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	31,000(EETD 88)
15	6,400(EETD 88)

CALIFORNIA CRUDE OIL (API GRAVITY:15)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	N/M(EETD 88)
15	33.6(EETD 88)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	N/M(EETD 88)
15	N/M(EETD 88)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	N/M(EETD 88)
15	N/M(EETD 88)

6.0 POUR POINT (°C): -9(EETD 88)

7.0 FLASH POINT (°C): 12(C.C)(EETD 88)

8.0 VAPOUR PRESSURE:

CALIFORNIA CRUDE OIL (API GRAVITY:15)

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	159	45
5	244	113
10	283	135
15	330	158
20	369	185
25	387	203
30	399	214
35	406	224
40	411	232
45	415	237
50	420	243
	(EETD 88)	(EETD 88)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 88)
15	0(EETD 88)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 88)
15	0(EETD 88)

CALIFORNIA CRUDE OIL (API GRAVITY:15)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (^{o}C)	WEATHERING (%)
	0
0	N/M(EETD 88)
15	N/M(EETD 88)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 11{,}749.3\ \Theta\ \exp(6.3 - 4{,}602.8/T_k)/T_k)}{(11{,}749.3 / T_k)}$$

where:

Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporative exposure
exp is exponential base e
T_k is environmental temperature
(Kevin, K = ^{o}C + 273)
(EETD 88)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	1
CRX-8	1
ENER 700	1
DASIC	2 (FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15^{o}C (% DISPERSED): 0 (FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	13.7
AROMATICS	36.4
POLARS	24.1
ASPHALTENES	25.8(MACKAY 88) 20.1(EETD 89)

CALIFORNIA CRUDE OIL (API GRAVITY:15)

14.0 WAX CONTENT (WT %): 1.6(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in double distilled water @ 22°C:	25.7(MACKAY 88)
in salt water @ 22°C:	14.7(MACKAY 88)

16.0 TOXICITY:

17.0 SULPHUR (WT %): 5.5(EETD 88)

18.0 OTHERS:

COHASSET CRUDE OIL

1.0 TYPE: Cohasset A-52 Crude Oil, Offshore Nova Scotia.
Data for equilibrium liquid of separator flash test.

2.0 API GRAVITY (15.5/15.5°C): 50.1(PETRO-CAN 87)

3.0 DENSITY (g/mL):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	11.2	25.6
1	0.8002(EETD 89)	0.8149(EETD 89)	0.8469(EETD 89)
15	0.7900(EETD 89) 0.7789(PETRO-CAN 87)	0.8046(EETD 89)	0.8367(EETD 89)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	11.2	25.6
1	2.79(EETD 89)	4.05(EETD 89)	7.23(EETD 89)
15	2.06(EETD 89) 0.7789(PETRO-CAN 87)	2.70(EETD 89)	4.83(EETD 89)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	11.2	25.6
0	25.7(EETD 89)	25.4(EETD 89)	27.4(EETD 89)
15	25.6(EETD 89)	25.2(EETD 89)	26.8(EETD 89)

COHASSET CRUDE OIL

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (VOLUME %) 11.2	25.6
0	15.3(EETD 89)	13.1(EETD 89)	12.1(EETD 89)
15	16.5(EETD 89)	12.5(EETD 89)	13.0(EETD 89)

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-30
11.2	-18
25.6	-12

7.0 FLASH POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	32
11.2	40
25.6	82

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

COHASSET CRUDE OIL

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (VOLUME %) 0	11.2	25.6
0	0(EETD 89)	0(EETD 89)	0(EETD 89)
15	0(EETD 89)	0(EETD 89)	0(EETD 89)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0	11.2	25.6
0	0(EETD 89)	0(EETD 89)	0(EETD 89)
15	0(EETD 89)	0(EETD 89)	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0	11.2	25.6
0	N/M(EETD 89)	N/M(EETD 89)	N/M(EETD 89)
15	N/M(EETD 89)	N/M(EETD 89)	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	WEATHERING (VOLUME %)	% EFFECTIVENESS
C9527	0	95
	11.2	96
	25.6	88
	28.1	90(FINGAS 90)

COHASSET CRUDE OIL

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED):

WEATHERING (VOLUME %)	% DISPERSED
0	6
11.2	6
25.6	5
28.1	4(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

WEATHERING (VOLUME %)	ASPHALTENES (WEIGHT %)
0	0.35
11.2	0.24
25.6	0.46
28.1	0.32(EETD 89)

14.0 WAX CONTENT (WT %):

WEATHERING (VOLUME %)	WAX (WT %)
0	0.90
11.2	1.31
25.6	1.20
28.1	1.48(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

COHASSET CRUDE OIL

18.0 OTHERS:

18.1 RELATIVE MOLECULAR MASS: 148.2(PETRO-CAN 87)

18.2 COMPOSITIONAL ANALYSIS:

COMPONENT	MOLE FRACTION	MASS FRACTION	VOLUME FRACTION
N_2	0.0000	0.0000	0.0000
CO_2	0.0000	0.0000	0.0000
H_2S	0.0000	0.0000	0.0000
C_1	0.0032	0.0003	0.0009
C_2	0.0007	0.0001	0.0003
C_3	0.0020	0.0006	0.0009
iC_4	0.0023	0.0009	0.0012
C_4	0.0032	0.0013	0.0017
iC_5	0.0090	0.0044	0.0055
C_5	0.0108	0.0053	0.0065
C_6	0.0589	0.0337	
C_7	0.0969	0.0646	
C_8	0.1288	0.0979	
C_9	0.0819	0.0699	
C_{10}	0.0894	0.0846	
C_{11}	0.0722	0.0750	
C_{12}	0.0583	0.0661	
C_{13}	0.0529	0.0649	
C_{14}	0.0451	0.0595	
C_{15}	0.0400	0.0565	
C_{16}	0.0285	0.0430	
C_{17}	0.0241	0.0385	
C_{18}	0.0167	0.0282	
C_{19}	0.0132	0.0235	
C_{20}	0.0102	0.0191	
C_{21}	0.0086	0.0170	
C_{22}	0.0070	0.0144	
C_{23}	0.0049	0.0106	
C_{24}	0.0040	0.0091	
C_{25}	0.0032	0.0076	
C_{26}	0.0024	0.0059	
C_{27}	0.0022	0.0056	
C_{28}	0.0014	0.0037	
C_{29}	0.0010	0.0028	
C_{30+}	0.0031	0.0102	

18.2 COMPOSITIONAL ANALYSIS continued:

AROMATICS:

COMPONENT	MOLE FRACTION	MASS FRACTION	VOLUME FRACTION
C_6H_6	0.0014	0.0007	
C_7H_8	0.0071	0.0044	
C_8H_{10}	0.0234	0.0166	
C_8H_{10}	0.0102	0.0072	
C_9H_{12}	0.0090	0.0072	
NAPHTHENES:			
C_5H_{10}	0.0037	0.0017	
C_6H_{12}	0.0073	0.0041	
C_6H_{12}	0.0054	0.0030	
C_7H_{14}	0.0464	0.0303 (PETRO-CAN 87)	

COLD LAKE BITUMEN

1.0 TYPE: Cold Lake Bitumen from Esso Resources Canada.

2.0 API GRAVITY: 9.8(EETD 88)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	1.0075(EETD 88)
5	1.0049(EETD 88)
10	1.0023(EETD 88)
15	1.0002(EETD 88)
20	0.9968(EETD 88)
25	0.9943(EETD 88)
30	0.9916(EETD 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	>3,000,000(EETD 88)
15	235,000(EETD 88)

5.0 INTERFACIAL TENSIONS: N/M(EETD 88)

6.0 POUR POINT (°C): 9(EETD 88)

7.0 FLASH POINT (°C): 81(EETD 88)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

Distillation showed that bitumen contained approximately 10% water by volume. No other fractions were collected below a liquid temperature of 335 °C. (EETD 88)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 88)
15	0(EETD 88)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 88)
15	0(EETD 88)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%)
	0
0	N/M(EETD 88)
15	N/M(EETD 88)

11.0 WEATHERING:

12.0 DISPERSIBILITY: N/M(EETD 88)

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	1
CRX-8	1
ENER-700	1
DASIC	1(FINGAS 90)

12.2 NATURAL DISPERSIBILITY (% DISPERSED): 0(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	16.6
AROMATICS	39.2
POLARS	24.9
ASPHALTENES	19.3(MACKAY 88) 11.9(EETD 89)

14.0 WAX CONTENT (WT %): 1.35(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in double distilled water @ 22 °C:	0.26(MACKAY 88)
in seawater water @ 22 °C:	0.13(MACKAY 88)

16.0 TOXICITY:

17.0 SULPHUR (WT %): 6.9(EETD 88)

18.0 OTHERS:

COLD LAKE CRUDE OIL

1.0 TYPE: Cold Lake Crude Oil, Alberta.

2.0 API GRAVITY: 25.2 (NSD 88)

3.0 DENSITY (g/mL): 0.9031(AALUND 83a)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 15 °C: 70.7(AALUND 83a)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -60(AALUND 83a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.91(AALUND 83a)

18.0 OTHERS:

18.1 NITROGEN (WT %): 0.29(AALUND 83a)

18.2 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_5 & lighter		7.43
NAPHTHA	20-175	30.0
DISTILLATE	175-295	10.5
GAS OIL	343-517	18.7
RESIDIUM	343+	51.6
ASPHALT	405+	47.8
ASPHALT	470+	37.7

(AALUND 83a)

COLD LAKE DILBIT

1.0 TYPE: Cold Lake Dilbit from Esso Resources Canada. Blend of Cold Lake Bitumen and Diluent.

2.0 API GRAVITY (15/15°C): 22.6(EETD 88)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.9273(EETD 88)
15	0.9172(EETD 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	425(EETD 88)
15	150(EETD 88)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	29.2(EETD 88)
15	27.1(EETD 88)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	28.1(EETD 88)
15	16.3(EETD 88)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	28.3(EETD 88)
15	21.7(EETD 88)

6.0 POUR POINT (°C): -45(EETD 88)

7.0 FLASH POINT (°C): <-35(EETD 88)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	78	29
5	127	41
10	189	60
15	276	72
20	353	145
25	391	198
30	409	222
35	419	234
40	426	249
45	435	260
50	439	262
55	443	263
60	445(EETD 88)	263(EETD 88)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%)
	0
0	1.0(EETD 88)
15	1.0(EETD 88)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%)
	0
0	1.0(EETD 88)
15	1.0(EETD 88)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%)
	0
0	65(EETD 88)
15	71(EETD 88)

11.0 WEATHERING:

$$F_v = \frac{\ln(1 + 14{,}652.47\ \Theta \exp(6.3 - 3{,}424.24/T_K)/T_K)}{(14{,}652.47/T_K)}$$

where:
F_v is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_K is environmental temperature
(Kelvin, K = °C + 273) (EETD 88)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L): in distilled water @ 25 °C: 28.2(EETD 88)

16.0 TOXICITY:

17.0 SULPHUR (WT %): 4.72(EETD 88)

18.0 OTHERS:

COLD LAKE DILUENT

1.0 TYPE: Cold Lake Diluent from Esso Resources Canada.
Diluent used in Cold Lake Dilbit.

2.0 API GRAVITY (15/15°C): 69.3(EETD 88)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.7162(EETD 88)
15	0.7040(EETD 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	0.66(EETD 88)
15	0.62(EETD 88)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	20.0(EETD 88)
15	19.9(EETD 88)

COLD LAKE DILUENT

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	7.5(EETD 88)
15	6.8(EETD 88)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	8.3(EETD 88)
15	8.3(EETD 88)

6.0 POUR POINT (°C): <-75(EETD 88)

7.0 FLASH POINT (°C): <-35(EETD 88)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	47	23
5	55	42
10	60	45
15	65	48
20	70	49
25	77	49
30	85	49
35	93	52
40	103	56
45	113	68
50	121	73
55	131	77
60	144	89
65	162	97
70	190(EETD 88)	101(EETD 88)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 88)
15	0(EETD 88)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 88)
15	0(EETD 88)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%)
	0
0	N/M(EETD 88)
15	N/M(EETD 88)

11.0 WEATHERING:

$$F_v = \frac{\ln(1 + 1{,}848.34\ \Theta\ \exp\ (6.3 - 3{,}193.93/T_K)/T_K)}{(1{,}848.34/T_K)}$$

where:
F_v is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_K is environmental temperature
(Kelvin, K = °C + 273) (EETD 88)

COLD LAKE DILUENT

12.0 DISPERSIBILITY: N/M(EETD 88)

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L): in distilled water @ 25 °C: 57.9(EETD 88)

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.25(EETD 88)

18.0 OTHERS:

COOK INLET CRUDE OIL

1.0 TYPE: Cook Inlet Crude Oil, Alaska.

2.0 API GRAVITY:

3.0 DENSITY:

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILTY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

COOK INLET CRUDE OIL

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION: SPECIES	96 hour LC$_{50}$ (mg/L of aromatics)
FISH:	
CLUPEA PALLASII	1.22
SALVELINUS MALMA	1.55
ONCORHYNCHUS GORBUSCHA	1.69
THERAGRA CHALCOGRAMMUS	1.73
AULORHYNCHUS FLAVIDUS	2.55
MYOXOCEPHALUS POLYACANTHCEPHALUS	3.96
PLATICHTHYS STELLATUS	>5.34
PHOLIS LAETA	>11.72
ANOPLARCHUS PURPURESCENS	>11.72
CRUSTACEANS:	
CRANGON ALASKENSIS	0.87
PANDALUS GONIURUS	1.79
EUALUS SUCKLEYI	1.86
PANDALUS BOREALIS	4.94
PARALITHODES CAMTSCHATICA	3.69
HEMIGRAPSIS NUDUS	8.45
PAGURUS HIRSUITICULUS	>10.58
ORCHOMENE PINGUIS	>7.98
ACANTHOMYSIS PSEUDOMACROPSIS	>9.02
ECHINODERMS:	
CUCUMARIA VEGA	>6.84
STRONGYLOCENTROTUS DROBACHIENSIS	>10.58
LEPTASTERIAS HEXACTIS	>10.58
EUPENTACTA QUINQUESIMITA	>12.29
MOLLUSKS:	
CHLAMYS HERICUS	3.94
MYTILUS EDULIS	>8.97
PROTOTHACA STAMINEA	>6.84
COLLISELLA SCUTUM	8.18
NOTOACMAECA PELTA	>8.46
KATHARINA TUNICATA	>8.46
TONICELLA LINEATA	>8.46
MOPALIA CILLIATA	>8.46
MARGARITES PUPILLUS	>8.46
LITTORINA SITKANA	>8.46
THAIS LIMA	>8.46
COLUS HALLI	>8.46
NEPTUNEA LYRATA	>10.58

16.0 TOXICITY (mg/L) continued:

ACUTE TOXICITY OF WATER SOLUBLE FRACTION:

SPECIES	96 hour LC_{50} (mg/L of aromatics)
ANNELIDS:	
NEREIS VEXILLOSA	>10.58
HARMOTHOE IMBRICATA	>10.58
NEMERTEANS:	
PARANEMERTES PEREGRINA	>10.58
LINEUS VEGETUS	>10.58(RICE 79)

17.0 SULPHUR:

18.0 OTHERS:

DAN CRUDE OIL

1.0 TYPE: Dan Crude Oil (Denmark North Sea). Contributor to Gorm Blend.

2.0 API GRAVITY (15/15°C): 30.4 (AALUND 83b)

3.0 DENSITY:

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40°C: 8.90 (AALUND 83b)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): <-45.0 (AALUND 83b)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.34 (AALUND 83b)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_4 & LIGHTER		0.80
LIGHT GASOLINE	C_5-93	5.80
NAPHTHA	93-207	20.3
LIGHT GAS OIL	207-343	26.6
RESIDUE	343+	46.5

(AALUND 83b)

DIESEL FUEL OIL

1.0 TYPE: Automotive Diesel Fuel Oil.
Also see Fuel Oil No.2.
Data from reference (EETD 85) are based on diesel sample purchased from a service station in the summer of 1984.

Grade 1-D: Straight-run fractions including kerosines to intermediate distillates from paraffinic crude or treated fractions from mixed-base crudes. Used for mobile service such as trucks, railroads and submarines.

Grade 2-D: Similar to Grade 1-D but with lower volatility. Used for industrial and heavy mobile service.

Grade 4-D: Residual fuel oils blended with more viscous distillates. Used for larger stationary installations (ASTM D 975).

2.0 API GRAVITY (15/15°C): 39.4(EETD 84)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%)	
	0	27.9
0	0.838(EETD 84)	0.8450(EETD 89)
15	0.827(EETD 84)	0.8350(EETD 89)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%)
	0
0	3.9(EETD 85)
15	2.7(EETD 85)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

@ 40°C:
grade 1-D: 1.3 TO 2.4
grade 2-D: 1.9 TO 4.1
grade 4-D: 5.5 TO 24.0(ASTM D 975)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	27.7(EETD 84)
15	26.0(EETD 84)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	28.2(EETD 85)
15	28.0(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	30.1(EETD 85)
15	29.4(EETD 85)

6.0 POUR POINT (°C):
-20(FINGAS 79)
-30(EETD 86)

7.0 FLASH POINT (°C):
55(FINGAS 79)
grade 1-D: minimum, 38(ASTM D 975)
grade 2-D: minimum, 52(ASTM D 975)
grade 4-D: minimum, 55(ASTM D 975)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)
90	grade 1-D: 288, max grade 2-D: 282-338

(ASTM D 975)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	0	WEATHERING (%) 27.9
0	0(EETD 85)	
15	0(EETD 85)	0(EETD 89)

10.2 EMULSION STABILITY:

TEMP (°C)	0	WEATHERING (%) 27.9
0	0(EETD 85)	
15	0(EETD 85)	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	0	WEATHERING (%) 27.9
0	N/M(EETD 85)	
15	N/M(EETD 85)	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 1.88 (EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

In fresh water @ 22°C:	2.8(SUNTIO 86)
Gulf P20 diesel in distilled water:	2.3(MURRAY 84)
Gulf P40 diesel in distilled water:	8.3(MURRAY 84)
In fresh water:	39.1(MACLEAN 88)
In seawater:	60.4(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

48 hour EC_{50}:	4.07(MACLEAN 88) 0.29(BOBRA 88)
48 hour LC_{50}:	7.16(MACLEAN 88) 0.57(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

48 hour EC_{50}:	21.7(MACLEAN 88) 0.80(BOBRA 88)
48 hour LC_{50}:	23.7(MACLEAN 88) 0.88(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO LARVAL RAINBOW TROUT:

48 hour LC_{50} (closed container):	2.43(LOCKHART 87)
48 hour LC_{50} (open container):	2.52(LOCKHART 87)

17.0 SULPHUR (WT%): 0.10(EETD 86)
winter diesel: 0.16(EETD 86)
grade 1-D: maximum, 0.50(ASTM D 975)
grade 2-D: maximum, 0.50(ASTM D 975)
grade 4-D: maximum, 2.0(ASTM D 975)

18.0 OTHERS:

18.1 CLOUD POINT (°C): winter diesel grade I: -23(TSANG 86)
winter diesel grade II: -32(TSANG 86)

18.2 INITIAL BOILING POINT (°C): 180 TO 360(FINGAS 79)

DUNLIN CRUDE OIL

1.0 TYPE: Dunlin Crude Oil (UK North Sea). Contributor to the Brent system at Sullom Voe, Shetland Islands.

2.0 API GRAVITY (15/15°C): 34.9 (NSD 88)

3.0 DENSITY (g/mL): 0.8500 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40°C: 4.9 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 6.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 4.30 (NSD 88)
5.0 (AALUND 83b)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.39 (NSD 88)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 2.50 (NSD 88)

18.2 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1-C_4		2.3
GASOLINE	C_5-85	6.8
NAPHTHA	85-165	15.2
KEROSINE	165-235	11.8
GAS OIL	235-300	13.0
GAS OIL	300-350	10.0
RESIDUE	350+	41.2

(AALUND 83b)

EAST TEXAS CRUDE OIL

1.0 TYPE: East Texas Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 38.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8350 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 4.30 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.50 (NSD 88)

18.0 OTHERS:

EKOFISK CRUDE OIL

1.0 TYPE: Ekofisk Crude Oil, Norway North Sea. Phillips Petroleum.

2.0 API GRAVITY: 35.6(HMSO 76)
43.4(AALUND 83b)

3.0 DENSITY (g/mL): @ 15 °C: 0.847(HMSO 76)
0.8060 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 20 °C: 3.00(NSD 88)
@ 50 °C: 4.25(HMSO 76)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -5(HMSO 76)
-12(AALUND 83b)
-16(NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 34.5(AALUND 83b)

9.0 DISTILLATION DATA:

WEIGHT PERCENT	TEMP (°C)
7	5 TO 100(HMSO 76),(CORMACK 78)
11.1	100 TO 160(HMSO 76),(CORMACK 78)
15.1	160 TO 250(HMSO 76),(CORMACK 78)
19	250 TO 350(HMSO 76),(CORMACK 78)
47.8	>350(HMSO 76),(CORMACK 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.03(CORMACK 78)

14.0 WAX CONTENT (WT %): 6.5 (HMSO 76)
4.5 (NSD 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.18(HMSO 76)
0.14(AALUND 83b)
0.21(NSD 88)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOL %
C_1-C_5		6.43
GASOLINE	IBP-80	11.9
NAPHTHA	80-150	20.2
GAS OIL	150-375	37.3
HEAVY GAS OIL	375-525	13.2

(AALUND 83b)

ELECTRICAL INSULATING OIL (VIRGIN)

1.0 TYPE: Electrical Insulating Oil, Voltesso 35.
Sample obtained from Ontario Hydro.
Naphthenic-based oil for use in electrical transformers, circuit breakers and other kinds of electrical equipment.

2.0 API GRAVITY(15/15°C): 31.6(ESSO 84)
28.8(EETD 85)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.8922(EETD 85)
15	0.8818(EETD 85) 0.8666(ESSO 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	37.8(EETD 85)
15	18.8(EETD 85)

ELECTRICAL INSULATING OIL (VIRGIN)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
-45	5000(ESSO 84)
-40	2000(ESSO 84)
-30	600(ESSO 84)
0	42.4(EETD 85) 50(ESSO 84)
15	21.3(EETD 85)
40	8.0(EETD 84)
100	2.2(ESSO 84)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	30.2(EETD 85)
15	29.6(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	17.7(EETD 85)
15	14.2(EETD 85)

ELECTRICAL INSULATING OIL (VIRGIN)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	20.2(EETD 85)
15	19.8(EETD 85)

6.0 POUR POINT (°C): <-34(EETD 85)
-51(ESSO 84)

7.0 FLASH POINT (°C): >110(C.C.)(EETD 85)
151(COC)(ESSO 84)

8.0 VAPOUR PRESSURE: @ 40 °C: 3 microns(ESSO 84)
@ 100 °C: 350 microns(ESSO 84)
@ 150 °C: 5mm(ESSO 84)
@ 200 °C: 45mm(ESSO 84)

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C)
10	278
20	297
50	336
90	390
95	404 (ESSO 84)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 85)
15	0(EETD 85)

ELECTRICAL INSULATING OIL (VIRGIN)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 85)
15	0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 85)
15	N/M(EETD 85)

11.0 WEATHERING: Insulating oil did not weather when stripped by air at room temperature. (EETD 85)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	78
AROMATICS & POLARS	22

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.15(ESSO 84)
0.08(EETD 86)

18.0 OTHERS:

18.1 WATER SATURATION LEVELS (PPM):

@ 0 °C:	16
@ 10 °C:	27
@ 15 °C:	35
@ 20 °C:	45
@ 25 °C:	56(ESSO 84)

18.2 ANILINE POINT (°C): 81(ESSO 84)

18.3 FIRE POINT (°C): 177(COC)(ESSO 84)

18.4 AIR SOLUBILITY (VOL %): @ 15.6 °C: 9.8(ESSO 84)

18.5 TOTAL ACID No.: NIL(ESSO 84)

18.6 OCCUPATIONAL EXPOSURE LIMIT (mg/m^3): FOR OIL MISTS: 5(ACGIH 83)

18.7 COLOR: 0.5(ESSO 84)

ELECTRICAL INSULATING OIL (USED)

1.0 TYPE: Used electrical Insulating Oil, Voltesso 35.
Sample obtained from Ontario Hydro.
Naphthenic-based oil used in electrical transformers,
circuit breakers and other kinds of electrical equipment.

2.0 API GRAVITY (15/15°C): 31.5(EETD 85)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%)
	0
0	0.8779(EETD 85)
15	0.8673(EETD 85)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%)
	0
0	35.8(EETD 85)
15	18.1(EETD 85)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%)
	0
0	40.8(EETD 85)
15	20.9(EETD 85)

ELECTRICAL INSULATING OIL (USED)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	30.6(EETD 85)
15	29.5(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	23.9(EETD 85)
15	16.7(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	24.1(EETD 85)
15	23.6(EETD 85)

6.0 POUR POINT (°C): <-34(EETD 85)

7.0 FLASH POINT (°C): >110(C.C.)(EETD 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

ELECTRICAL INSULATING OIL (USED)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 85)
15	0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 85)
15	0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%)
	0
0	N/M(EETD 85)
15	N/M(EETD 85)

11.0 WEATHERING: Insulating oil did not weather when stripped by air at room temperature. (EETD 85)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

ELECTRICAL INSULATING OIL (USED)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.10(EETD 86)

18.0 OTHERS:

ELECTRICAL LUBRICATING OIL (VIRGIN)

1.0 TYPE: New "Lube 27" Grade lubricating oil. Sample obtained from Ontario Hydro. Lube 27 is used in hydraulic turbine and governor systems of hydraulic generating stations.

2.0 API GRAVITY (15/15°C): 30.5(EETD 85)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%)
	0
0	0.8820(EETD 85)
15	0.8727(EETD 85)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%)
	0
0	350(EETD 85)
15	144(EETD 85)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%)
	0
0	396.8(EETD 85)
15	165(EETD 85)

ELECTRICAL LUBRICATING OIL (VIRGIN)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	32.8(EETD 85)
15	31.2(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	19.0(EETD 85)
15	13.6(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	22.3(EETD 85)
15	19.4(EETD 85)

6.0 POUR POINT (°C): -24(EETD 85)

7.0 FLASH POINT (°C): >110(C.C.)(EETD 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

ELECTRICAL LUBRICATING OIL (VIRGIN)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 85)
15	0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%)
	0
0	0(EETD 85)
15	0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%)
	0
0	N/M(EETD 85)
15	N/M(EETD 85)

11.0 WEATHERING: Lube 27 did not weather when stripped by air at room temperature. (EETD 85)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

ELECTRICAL LUBRICATING OIL (VIRGIN)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.43(EETD 86)

18.0 OTHERS:

ELECTRICAL LUBRICATING OIL (USED)

1.0 TYPE: Used "LUBE 27" grade lubricating oil.
Sample obtained from Ontario Hydro. LUBE 27 is used in hydraulic turbine and governor systems of hydraulic generating stations.

2.0 API GRAVITY (15/15°C): 30.3(EETD 85)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	0.8834(EETD 85)
15	0.8737(EETD 85)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	359(EETD 85)
15	145(EETD 85)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	406(EETD 85)
15	176(EETD 85)

ELECTRICAL LUBRICATING OIL (USED)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	31.9(EETD 85)
15	31.0(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	21.8(EETD 85)
15	11.4(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	24.4(EETD 85)
15	22.0(EETD 85)

6.0 POUR POINT (°C): -27(EETD 85)

7.0 FLASH POINT (°C): >110(C.C.)(EETD 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

ELECTRICAL LUBRICATING OIL (USED)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	0(EETD 85)
15	0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	0(EETD 85)
15	0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	N/M(EETD 85)
15	N/M(EETD 85)

11.0 WEATHERING: Lube 27 did not weather when stripped by air at room temperature. (EETD 85)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

ELECTRICAL LUBRICATING OIL (USED)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.43(EETD 86)

18.0 OTHERS:

ENDICOTT CRUDE OIL

1.0 TYPE: Endicott Crude Oil

2.0 API GRAVITY (15/15°C): 23.0(EETD 89)

3.0 DENSITY (g/mL):

TEMP (°C)	0	WEATHERING (VOLUME %) 8.4	12.6
0	0.9258(EETD 89)	0.9436(EETD 89)	0.9520(EETD 89)
15	0.9149(EETD 89)	0.9318(EETD 89)	0.9401(EETD 89)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	0	WEATHERING (VOLUME %) 8.4	12.6
0	501(EETD 89)	1583(EETD 89)	2609(EETD 89)
15	84(EETD 89)	321(EETD 89)	682(EETD 89)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (VOLUME %) 8.4	12.6
0	29.9(EETD 89)	30.8(EETD 89)	N/M(EETD 89)
15	29.1(EETD 89)	27.7(EETD 89)	30.9(EETD 89)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (VOLUME %) 8.4	12.6
0	26.1(EETD 89)	29.0(EETD 89)	N/M(EETD 89)
15	25.8(EETD 89)	26.0(EETD 89)	23.0(EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (VOLUME %) 8.4	12.6
0	26.2(EETD 89)	28.7(EETD 89)	N/M(EETD 89)
15	25.4(EETD 89)	24.4(EETD 89)	25.5(EETD 89)

6.0 POUR POINT (°C): -5(EETD 89)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 24.9(EETD 89)

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	162	42
5	259	82
10	309	151
15	346	160

(EETD 89)

10.0 EMULSION FORMATION AND TENDENCY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.4	12.6
0	1.0(EETD 89)	1.0(EETD 89)	0(EETD 89)
15	1.0(EETD 89)	1.0(EETD 89)	1.0(EETD 89)

10.2 EMULSION STABILITY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.4	12.6
0	0(EETD 89)	0(EETD 89)	0(EETD 89)
15	0(EETD 89)	0(EETD 89)	1.0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.4	12.6
0	N/M(EETD 89)	N/M(EETD 89)	N/M(EETD 89)
15	N/M(EETD 89)	N/M(EETD 89)	31.0(EETD 89)

11.0 WEATHERING:

ENDICOTT CRUDE OIL

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

WEATHERING (VOLUME %)	DISPERSANT	%EFFECTIVENESS
0	C9527	7
	CRX-8	8
	ENER 700	6
	DASIC	14
8.4	C9527	3
	CRX-8	4
	ENER 700	6
	DASIC	4
12.6	C9527	2
	CRX-8	2
	ENER 700	6
	DASIC	3 (FINGAS 90)

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

WEATHERING (VOLUME %)	% DISPERSED
0	3(FINGAS 90a)
8.4	3(FINGAS 90a)
12.6	2(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

WEATHERING (VOLUME %)	ASPHALTENES (WEIGHT %)
0	3.16(EETD 89)
8.4	4.00(EETD 89)
12.6	4.46(EETD 89)

14.0 WAX CONTENT (WT %):

WEATHERING (VOLUME %)	WAX (WT %)
0	0.54(EETD 89)
8.4	1.00(EETD 89)
12.6	1.38(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR (WT %)
0	1.34(EETD 89)
8.4	1.34(EETD 89)
12.6	1.40(EETD 89)

18.0 OTHERS:

FEDERATED CRUDE OIL

1.0 TYPE: Federated Crude Oil.

2.0 API GRAVITY (15/15°C): 39.7(EETD 86)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOLUME %) 0	14.3	31.4
0	0.8378(EETD 86)	0.8661(EETD 86)	0.8860(EETD 86)
15	0.8258(EETD 86)	0.8537(EETD 86)	0.8742(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0	14.3	31.4
0	10.0(EETD 86)	207(EETD 86)	40,000(EETD 86)
15	4.5(EETD 86)	10.7(EETD 86)	140.7(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (VOLUME %) 0	14.3	31.4
0	15.8(EETD 86)	239(EETD 86)	N/M(EETD 86)
15	5.2(EETD 86)	12.6(EETD 86)	161(EETD 86)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	14.3	31.4
0	26.9(EETD 86)	28.3(EETD 86)	N/M(EETD 86)
15	25.7(EETD 86)	28.0(EETD 86)	29.5(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	14.3	31.4
0	22.4(EETD 86)	23.1(EETD 86)	N/M(EETD 86)
15	22.2(EETD 86)	23.0(EETD 86)	24.1(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	14.3	31.4
0	23.6(EETD 86)	25.9(EETD 86)	N/M(EETD 86)
15	23.1(EETD 86)	24.4(EETD 86)	24.6(EETD 86)

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-9(EETD 86)
14.3	3(EETD 86)
31.4	9(EETD 86)

FEDERATED CRUDE OIL

7.0 FLASH POINT (^{o}C): -26(C.C)(EETD 86)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (^{o}C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	105	28
5	145	89
10	165	108
15	184	118
20	203	120
25	225	121
30	249	124
35	274	132
40	299	144
45	324	159
50	350	176
55	373	195
60	396	215
65	414	245
70	433	272
75	450	304
80	464	323
85	477	338
90	484	345
	(EETD 86)	(EETD 86)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP		WEATHERING (VOLUME %)	
(°C)	0	14.3	31.4
0	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)
15	0.3(EETD 86)	1.0(EETD 86)	1.0(EETD 86)

10.2 EMULSION STABILITY:

TEMP		WEATHERING (VOLUME %)	
(°C)	0	14.3	31.4
0	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)
15	0.07(EETD 86)	0.5(EETD 86)	1.0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP		WEATHERING (VOLUME %)	
(°C)	0	14.3	31.4
0	89.3(EETD 86)	88.5(EETD 86)	88.3(EETD 86)
15	90.0(EETD 86)	90.0(EETD 86)	89.8(EETD 86)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 4570\ \theta\ \exp(6.3 - 4024\ /T_k)/T_k)}{(4570/T_k)}$$

where:

Fv is fraction of oil weathered by volume
ln is natural log
θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(EETD 86)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	25
CRX-8	31
ENER 700	40
DASIC	38 (FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 3(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	87.1
AROMATICS	10.9
POLARS	1.3
ASPHALTENES	0.7 (EETD 86) 0.9 (EETD 89)

14.0 WAX CONTENT (WT %): 1.96(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR CONTENT (WT %)
0	0.21(EETD 86)
14.3	0.16(EETD 86)
31.4	0.35(EETD 86)

18.0 OTHERS:

FEDERATED L & M CRUDE OIL

1.0 TYPE: Federated Light and Medium Crude Oil, Alberta.

2.0 API GRAVITY: 39.7(AALUND 83a)

3.0 DENSITY (g/mL): @ 21 °C: 0.8258(AALUND 83a)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40 °C: 42.42 (AALUND 83a)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -10(AALUND 83a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 31.0(AALUND 83a)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 9.12 (AALUND 83a)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (PPM): 2010(AALUND 83a)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 1.46(AALUND 83a)

18.2 METALS (PPM): NICKEL: 0.07(AALUND 83a)
VANADIUM: 0.00(AALUND 83a)

18.3 NITROGEN (WT %): 0.11(AALUND 83a)

18.4 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
NAPHTHA	C_5-190	30.90
KEROSINE	190-277	18.25
DISTILLATE	277-343	13.73
GAS OIL	343-565	28.29
RESIDUE	565+	8.83

(AALUND 83a)

FLOTTA MIX CRUDE OIL

1.0 TYPE: Flotta Mix Crude Oil (UK, North Sea).
Flotta is a blend made up of Piper, Claymore, and Tartan crudes. (Aalund 83b)

2.0 API GRAVITY (15/15°C): 35.7 (NSD 88)

3.0 DENSITY (g/mL): 0.8460 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @4°C: 30.8 (AALUND 83b)
@40°C: 4.40 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -9 (NSD 88)
-6 (AALUND 83b)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): @38°C: 62.7 (AALUND 83b)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 5.50 (NSD 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.06 (NSD 88)
1.14 (AALUND 83b)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 3.29 (NSD 88)

18.2 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
	C_1-C_5	4.3
NAPHTHA	C_5-65	5.0
NAPHTHA	65-150	14.9
NAPHTHA	150-180	5.6
KEROSINE	180-235	8.0
GAS OIL	235-300	11.8
GAS OIL	300-343	8.4
RESIDUE	343+	42.0

(AALUND 83b)

FORTIES CRUDE OIL

1.0 TYPE: Forties Crude Oil, British Petroleum, UK, North Sea.

2.0 API GRAVITY (15/15°C): 37.35 (HMSO 76)
37.4 (LYNCH 81)
36.6 (AALUND 83b)

3.0 DENSITY (g/mL): @15 °C: 0.838 (HMSO 76)
@16 °C: 0.8373(LYNCH 81)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @10°C: 9.6 (AALUND 83b)
@20°C: 6.8 (NSD 88)
@21.1°C: 6.81(AALUND 83b)
@50°C: 3.7(LYNCH 81)(HMSO 76)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -1(HMSO 76)
-3(LYNCH 81)
-3 (AALUND 83b)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

WEIGHT %	TEMP °C
7.9	5 TO 100 (HMSO 76) (LYNCH 81)
11.7	100 TO 160 (HMSO 76) (LYNCH 81)
12.5	160 TO 250 (HMSO 76) (LYNCH 81)
21.9	250 TO 350 (HMSO 76) (LYNCH 81)
46.0	350+ (HMSO 76) (LYNCH 81)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

FORTIES CRUDE OIL

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.2 (AALUND 83b)
0.2 (IP METHOD 143/57) (LYNCH 81)

14.0 WAX CONTENT (WT %):
9 (HMSO 76)
9 (LYNCH 81)
7.0 (AALUND 83b)
3.8 (NSD 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):
0.29 (HMSO 76)
0.30 (AALUND 83b)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 2.2 (AALUND 83d)

18.2 METALS (PPM WT):
NICKEL: 2(AALUND 83d)
VANADIUM: 3(AALUND 83d)

18.3 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
	C_1-C_4	2.74 (WT%)
NAPHTHA	C_5-65	5.0
NAPHTHA	65-150	14.9
NAPHTHA	150-180	5.6
KEROSINE	180-235	8.0
GAS OIL	235-300	11.8
GAS OIL	300-343	8.4
RESIDUE	343+	42.0

(AALUND 83c)

FOSTERTON CRUDE OIL

1.0 TYPE: Fosterton Crude Oil (Canada).

2.0 API GRAVITY (15/15°C): 24.1 (NSD 88)

3.0 DENSITY (g/mL): 0.9090 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 30.0 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -9.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.79 (NSD 88)

18.0 OTHERS:

FUEL OIL NO.1 (KEROSINE)

1.0 TYPE: Fuel Oil No.1, Kerosine.

2.0 API GRAVITY (15/15°C): 39.4 TO 34.8(CURL 77)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.837 TO 0.847(CURL 77)
15	0.827 TO 0.850(CURL 77) 0.8495, MAX (ASTM D 396)
20	0.823 TO 0.847(CURL 77)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	3.1 TO 5.0(CURL 77)
15	2.1 TO 3.5(CURL 77)
20	1.9 TO 3.3(CURL 77)
38	1.4 TO 2.2(ASTM D 396)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C):	-18(CURL 77) -18, MAX (ASTM D 396)
7.0 FLASH POINT (°C):	38 TO 74(CURL 77) 38, MIN (ASTM D 396)

8.0 VAPOUR PRESSURE:

FUEL OIL NO.1 (KEROSINE)

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	TEMPERATURE (°C)
10	215, MAX (ASTM D 396)
90	288, MAX (ASTM D 396)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

PARAFFINS	35(CURL 77)
NAPHTHENES	60(CURL 77)
AROMATICS	15(CURL 77)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO LARVAL RAINBOW TROUT (freshwater):

48 hour LC_{50} (closed container):	1.63 mg/L(LOCKHART 87)
48 hour LC_{50} (open container):	1.60 mg/L(LOCKHART 87)

ACUTE TOXICITY OF OIL-IN-WATER EMULSION (freshwater/flowthrough apparatus):

96 hour LC_{50}, fathead minnow:	56.7 uL/L(HEDTKE 82)
96 hour LC_{50}, frog larvae:	45.8 uL/L(HEDTKE 82)

17.0 SULPHUR (WT %): 0.5, MAX (ASTM D 396)

18.0 OTHERS:

18.1 AUTO-IGNITION TEMPERATURE (°C): 229(CURL 77)

18.2 EXPLOSION LIMITS OF VAPOUR IN AIR: UPPER: 5.0%(CURL 77)
LOWER: 0.7%(CURL 77)

18.3 BOILING RANGE (°C): 174 TO 266(CURL 77)

FUEL OIL NO.1 (JET FUEL, J.P.-1)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel, J.P.-1).

2.0 API GRAVITY:

3.0 DENSITY:

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT (°C): 35 TO 63(CURL 77)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 AUTO-IGNITION TEMPERATURE (°C): 229(CURL 77)

FUEL OIL NO.1 (J.P.-4)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel, J.P.-4).
65% Gasoline, 35% Light Petroleum Distillates (CURL 77).
U.S. Air Force wide-cut aviation turbine fuel (DUKEK 78).

2.0 API GRAVITY: 44.8 TO 56.7(DUKEK 78)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	0.7669(EETD 89)
15	0.7549(EETD 89) 0.751 TO 0.802(DUKEK 78) APPROXIMATELY 0.80(NAVAL 77)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	1.29(EETD 89)
15	0.94(EETD 89)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	22.7(EETD 89)
15	22.8(EETD 89)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	9.3(EETD 89)
15	17.0(EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	32.8(EETD 89)
15	36.0(EETD 89)

6.0 POUR POINT:

7.0 FLASH POINT (°C): -23 TO -1(CURL 77),
APPROXIMATELY -25(NAVAL 77)

8.0 VAPOUR PRESSURE (kPa): max: 14-21(DUKEK 78)

9.0 DISTILLATION DATA:

VOLUME PERCENT	LIQUID TEMPERATURE (°C)	VAPOUR TEMPERATURE (°C)
IBP	95(EETD 89)	23(EETD 89)
5	104(EETD 89)	84(EETD 89)
10	110(EETD 89)	92(EETD 89)
15	114(EETD 89)	99(EETD 89)
20	119(EETD 89)	102(EETD 89)
25	123(EETD 89)	108(EETD 89)
30	127(EETD 89)	112(EETD 89)
35	132(EETD 89)	117(EETD 89)
40	137(EETD 89)	122(EETD 89)
45	143(EETD 89)	128(EETD 89)
50	148(EETD 89)	133(EETD 89) 190,max(DUKEK 78)
55	154(EETD 89)	139(EETD 89)
60	161(EETD 89)	146(EETD 89)
65	168(EETD 89)	153(EETD 89)
70	175(EETD 89)	159(EETD 89)
75	183(EETD 89)	166(EETD 89)
80	194(EETD 89)	174(EETD 89)
FBP		270,max(DUKEK 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	0(EETD 89)
15	0(EETD 89)

FUEL OIL NO.1 (J.P.-4)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0
0	0(EETD 89)
15	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	N/M(EETD 89)
15	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (VOL %, maximum): AROMATICS: 25(DUKEK 78)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L):

in deionized water @ 20°C:	25.14(SMITH 81)
in seawater @ 20°C:	21.41(SMITH 81)

16.0 TOXICITY (mg/L):

Fresh water toxicity test:

96 hour LC_{50} (unspecified cut), Bluegill:	2(OHMTADS 81)
96 hour LC_{50} (agitated environment), Salmon fingerling:	500(OHMTADS 81)

Salt water toxicity test:

96 hour LC_{50} (unspecified cut), Menhaden:	16(OHMTADS 81)
96 HOUR LC_{50} (unspecified cut), Mullet:	4(OHMTADS 81)
96 hour LC_{50} (unspecified cut), Grass Shrimp:	100(OHMTADS 81)

17.0 SULPHUR (WT %): maximum, 0.4(DUKEK 78)
0.04 (EETD 89)

18.0 OTHERS:

18.1 AUTO-IGNITION TEMPERATURE (°C): 242(CURL 77)

18.2 FREEZING POINT (°C): maximum, -58(DUKEK 78)

18.3 HEAT CONTENT (MJ/kg): minimum, 42.8(DUKEK 78)

18.4 SMOKE POINT (mm): minimum, 20(DUKEK 78)

FUEL OIL NO.1 (J.P.-5)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel, J.P.-5).
Specially refined kerosine (Curl 77).
A high flash point kerosine (Dukek 78).

2.0 API GRAVITY: 35.8 TO 47.9(DUKEK 78)

3.0 DENSITY (g/mL): @ 15 °C: 0.788 TO 0.845(DUKEK 78)
maximum, 0.844(NAVAL 77)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/s or cSt): @ -20 °C: maximum, 8.5(DUKEK 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT (°C): 35 TO 63(CURL 77),
minimum, 60(NAVAL 77)
minimum, 60(DUKEK 78)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C, max)
10	205
FBP	290

(DUKEK 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (VOL %, maximum): AROMATICS: 25(DUKEK 78)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY (mg/L):

Fresh water toxicity test:

96 hour LC_{50} (unspecified cut), Bluegill:	2(OHMTADS 81)
96 hour LC_{50} (agitated environment), Salmon fingerling:	500(OHMTADS 81)

Salt water toxicity test:

96 hour LC_{50} (unspecified cut), Menhaden:	16(OHMTADS 81)
96 hour LC_{50} (unspecified cut), Mullet:	4(OHMTADS 81)
96 hour LC_{50} (unspecified cut), Grass Shrimp:	100(OHMTADS 81)

17.0 SULPHUR (WT %): maximum, 0.4(DUKEK 78)

18.0 OTHERS:

18.1 AUTO-IGNITION TEMPERATURE (°C): 246(CURL 77)

18.2 FREEZING POINT (°C): maximum, -46(DUKEK 78)

18.3 HEAT CONTENT (KJ/kg): minimum, 42.6(DUKEK 78)

18.4 SMOKE POINT (mm): minimum, 19(DUKEK 78)

FUEL OIL NO.1 (J.P.-6)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel, J.P.-6).
A higher kerosine cut than J.P.-4 with fewer impurities.

2.0 API GRAVITY:

3.0 DENSITY:

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT (°C): 38(CURL 77)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 AUTO-IGNITION TEMPERATURE (°C): 224(CURL 77)

FUEL OIL NO.1 (J.P.-7)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel, J.P.-7).
A high flash point special kerosine used in advanced supersonic aircraft (Dukek 78).

2.0 API GRAVITY: 43.9 TO 50.0(DUKEK 78)

3.0 DENSITY (g/mL): @ 15°C: 0.779 TO 0.806(DUKEK 78)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ -20°C: maximum, 8.0(DUKEK 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT (°C): minimum, 60(DUKEK 78)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C, max)
10	196
FBP	288

(DUKEK 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (VOL %, maximum): AROMATICS: 5(DUKEK 78)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): maximum, 0.1(DUKEK 78)

18.0 OTHERS:

18.1 FREEZING POINT (°C): maximum, -43(DUKEK 78)

18.2 HEAT CONTENT (KJ/kg): minimum, 43.5(DUKEK 78)

18.3 SMOKE POINT (mm): minimum, 35(DUKEK 78)

FUEL OIL NO.1 (J.P.-8)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel, J.P.-8).
A kerosine modelled on Jet A-1 which is used in new military aircraft (Dukek 78).

2.0 API GRAVITY: 36.8 TO 50.9(DUKEK 78)

3.0 DENSITY (g/mL): @ 15°C: 0.775 TO 0.840(DUKEK 78)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ -20°C: maximum, 8.0(DUKEK 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT (°C): minimum, 38(DUKEK 78)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C, max)
10	205
FBP	300

(DUKEK 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (VOL %, maximum): AROMATICS: 25(DUKEK 78)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L):

in deionized water @ 20°C:	2.00(SMITH 81)
in seawater @ 20°C:	1.61(SMITH 81)

16.0 TOXICITY:

FUEL OIL NO.1 (J.P.-8)

17.0 SULPHUR (WT %): maximum, 0.4(DUKEK 78)

18.0 OTHERS:

18.1 FREEZING POINT (°C): maximum, -50(DUKEK 78)

18.2 HEAT CONTENT (KJ/kg): minimum, 42.8(DUKEK 78)

18.3 SMOKE POINT (mm): minimum, 20(DUKEK 78)

FUEL OIL NO.1 (JET FUEL A)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel A).
Also known as Jet A Kerosine or Turbo Fuel A.
A petroleum distillate blended from kerosine fractions and used in civil aviation. Operational fuel for commercial turboprop and turbojet aircraft in U.S.(Esso 73)

2.0 API GRAVITY: 42.0(ESSO 73)
36.8 TO 50.9(DUKEK 78)

3.0 DENSITY (g/mL):

@ 15°C: 0.775 TO 0.840(DUKEK 78)
@ 15°C: 0.7753 TO 0.8398(ASTM D 1655)
@ 15.6°C: 0.816(ESSO 73)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

@ -34.4°C: 7.9(ESSO 73)
@ -20°C: maximum, 8.0(DUKEK 78)(ASTM D 1655)
@ 0°C: 2.1(DUKEK 78)
@ 15°C: 1.6(DUKEK 78)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

@ 20°C: 23.3(CRC 83)
@ 40°C: 21.7(CRC 83)
@ 60°C: 20.2(CRC 83)

6.0 POUR POINT:

7.0 FLASH POINT (°C): minimum, 38(DUKEK 78)(ASTM D 1655)
46(ESSO 73)

8.0 VAPOUR PRESSURE:

FUEL OIL NO.1 (JET FUEL A)

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (^oC)
IBP	163(ESSO 73)
10	204, MAX(DUKEK 78)(ASTM D 1655) 179(ESSO 73)
20	184(ESSO 73)
50	203(ESSO 73)
90	232(ESSO 73)
FBP	300, MAX(DUKEK 78)(ASTM D 1655) 259(ESSO 73)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (VOL %):

AROMATICS: 20(DUKEK 78)
25, MAX (ASTM D 1655)
16(ESSO 73)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): maximum, 0.3(DUKEK 78)(ASTM D 1655)
0.05(ESSO 73)

18.0 OTHERS:

18.1 FREEZING POINT (^oC): maximum, -40(DUKEK 78)(ASTM D 1655)
-44(ESSO 73)

18.2 HEAT CONTENT (KJ/kg): minimum, 42.8(DUKEK 78)

18.3 SMOKE POINT (mm): minimum, 20(DUKEK 78)
minimum, 18(ASTM D 1655)
23(ESSO 73)

FUEL OIL NO.1 (JET FUEL A-1)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel A-1).
Also known as Jet A-1 Kerosine or Turbo Fuel A-1. A petroleum distillate blended from kerosine fractions and used in civil aviation. Jet A-1 is similar to Jet A except for a lower freezing point. Operational fuel for all turboprop and turbojet aircraft requiring a low freezing point product.(Esso 73)

2.0 API GRAVITY: 44.0(ESSO 73)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	0.8155(EETD 89)
15	0.8043(EETD 89)
15.6	0.806 (ESSO 73)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0	45.5
0	2.11(EETD 89)	3.10(EETD 89)
15	1.26(EETD 89)	2.39(EETD 89)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

@ -34.4°C:	7.9(ESSO 73)
@ 0°C:	1.5(DUKEK 78)
@ 15°C:	1.2(DUKEK 78)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	26.5(EETD 89)
15	26.0(EETD 89)
20	23.3(CRC 83)
40	21.7(CRC 83)
60	20.2(CRC 83)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	37.4(EETD 89)
15	38.4(EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	40.7(EETD 89)
15	40.4(EETD 89)

6.0 POUR POINT:

7.0 FLASH POINT (°C): 42(ESSO 73)

8.0 VAPOUR PRESSURE:

FUEL OIL NO.1 (JET FUEL A-1)

9.0 DISTILLATION DATA:

VOLUME PERCENT	LIQUID TEMPERATURE (°C)	VAPOUR TEMPERATURE (°C)
IBP	184(EETD 89)	163(ESSO 73) 139(EETD 89)
5	188(EETD 89)	171(EETD 89)
10	192(EETD 89)	179(ESSO 73) 176(EETD 89)
15	195(EETD 89)	181(EETD 89)
20	198(EETD 89)	184(ESSO 73) 184(EETD 89)
25	200(EETD 89)	187(EETD 89)
30	203(EETD 89)	191(EETD 89)
35	206(EETD 89)	194(EETD 89)
40	209(EETD 89)	197(EETD 89)
45	213(EETD 89)	200(EETD 89)
50	215(EETD 89)	203(ESSO 73) 203(EETD 89)
55	219(EETD 89)	207(EETD 89)
60	223(EETD 89)	210(EETD 89)
65	227(EETD 89)	214(EETD 89)
70	231(EETD 89)	218(EETD 89)
75	236(EETD 89)	223(EETD 89)
90		232(ESSO 73)
FBP		259(ESSO 73)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (VOLUME %) 0
0	0(EETD 89)
15	0(EETD 89)

FUEL OIL NO.1 (JET FUEL A-1)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0
0	0(EETD 89)
15	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	N/M(EETD 89)
15	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (VOL %): AROMATICS: 13(ESSO 73)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

FUEL OIL NO.1 (JET FUEL A-1)

17.0 SULPHUR (WT %):	0.05(ESSO 73) 0.04(EETD 89)
18.0 OTHERS:	
18.1 FREEZING POINT (^{o}C):	-51(ESSO 73) -47(ASTM D 1655)

18.2 SMOKE POINT (mm): 26(ESSO 73)

FUEL OIL NO.1 (JET FUEL B)

1.0 TYPE: Fuel Oil No.1 (Jet Fuel B).
Also known as Jet B wide-cut or Turbo Fuel B.
A wide-boiling-range petroleum distillate blended from gasoline and kerosine fractions. Operational fuel for U.S. and NATO military aircraft and for many commercial turboprop and turbojet aircraft.(Esso 73)

2.0 API GRAVITY: 53.8(ESSO 73)
44.8 TO 56.7(DUKEK 78)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOLUME %) 0	62.5
0	0.7689 (EETD 89)	0.8022 (EETD 89)
15	0.7567 (EETD 89) 0.751 TO 0.802(DUKEK 78)	0.7915 (EETD 89)
15.6	0.764(ESSO 73)	

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	1.04(EETD 89)
15	1.02(EETD 89)

5.0 INTERFACIAL TENSIONS:

5.1 OIL-AIR (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	23.1 (EETD 89)
15	23.0 (EETD 89)
20	21.8 (CRC 83)
40	20.5 (CRC 83)
60	18.4 (CRC 83)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	10.8 (EETD 89)
15	10.8 (EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %)
	0
0	10.8 (EETD 89)
15	12.4 (EETD 89)

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 38°C: maximum, 21(DUKEK 78)

FUEL OIL NO.1 (JET FUEL B)

9.0 DISTILLATION DATA:

VOLUME PERCENT	LIQUID TEMPERATURE (°C)	VAPOUR TEMPERATURE (°C)
IBP	92(EETD 89)	72(ESSO 73)
		25(EETD 89)
5	104(EETD 89)	124(ESSO 73)
		84(EETD 89)
10	110(EETD 89)	94(EETD 89)
15	115(EETD 89)	99(EETD 89)
20	120(EETD 89)	135(ESSO 73)
		104(EETD 89)
25	124(EETD 89)	109(EETD 89)
30	128(EETD 89)	114(EETD 89)
35	133(EETD 89)	118(EETD 89)
40	137(EETD 89)	123(EETD 89)
45	142(EETD 89)	128(EETD 89)
50	148(EETD 89)	159(ESSO 73)
		188, MAX(DUKEK 78)
		134(EETD 89)
55	153(EETD 89)	140(EETD 89)
60	159(EETD 89)	146(EETD 89)
65	165(EETD 89)	152(EETD 89)
70	171(EETD 89)	157(EETD 89)
75	177(EETD 89)	163(EETD 89)
90		193(ESSO 73)
FBP		235(ESSO 73)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (VOLUME %) 0	62.5
0	0(EETD 89)	0(EETD 89)
15	0(EETD 89)	0(EETD 89)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0	62.5
0	0(EETD 89)	0(EETD 89)
15	0(EETD 89)	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0	62.5
0	N/M(EETD 89)	N/M(EETD 89)
15	N/M(EETD 89)	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (VOL %):

AROMATICS:	maximum, 20(DUKEK 78) 11(ESSO 73)
OLEFINS:	1.0(ESSO 73)

14.0 WAX CONTENT:	
15.0 AQUEOUS SOLUBILITY:	
16.0 TOXICITY:	
17.0 SULPHUR (WT %):	maximum, 0.3(DUKEK 78) 0.04(ESSO 73)
18.0 OTHERS:	
18.1 FREEZING POINT (°C):	maximum, -50(DUKEK 78) -60(ESSO 73)
18.2 HEAT CONTENT (KJ/kg):	minimum, 42.8(DUKEK 78)
18.3 SMOKE POINT (mm):	minimum, 20(DUKEK 78) 29.0(ESSO 73)

FUEL OIL NO.2

1.0 TYPE: Fuel Oil No.2.
Also see Diesel Fuel Oil and Heating Fuel Oil.

2.0 API GRAVITY: 30 MIN(ASTM 80)
31.6(PANCIROV 74)

3.0 DENSITY (g/mL):

TEMP (^oC)	WEATHERING (%) 0
0	0.874(EETD 84) 0.849(MACKAY 82b) 0.865 TO 0.908(CURL 77)
15	0.866(EETD 84) 0.855 TO 0.898(CURL 77) 0.8757, MAX (ASTM D 396)
16.5	0.8762, MAX (ASTM D 396) 0.854 TO 0.897(CURL 77)
20	0.840(MACKAY 82b)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (^oC)	WEATHERING (%) 0
0	7.74(MACKAY 82b)
20	4.04(MACKAY 82b)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%)
	0
0	1.77 TO 4.00(CURL 77)
15	2.53 TO 6.13(CURL 77)
38	2.0 TO 3.6(ASTM D 396) 1.53 TO 3.19(CURL 77)
40	1.9 TO 3.4(ASTM D 396) 1.47 TO 3.01(CURL 77)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%)
	0
0	29.0(EETD 84)
15	27.4(EETD 84)
20	26.2(MACKAY 82b)

5.2 OIL-SEAWATER (mN/m or dynes/cm)

TEMP (°C)	WEATHERING (%)
	0
0	16.2(EETD 84)
15	13.6(EETD 84)
20	25.6(MACKAY 82b)

FUEL OIL NO.2

5.3 OIL-WATER (mN/m or dynes/cm)

TEMP (°C)	WEATHERING (%) 0
0	15.1(EETD 85)
15	14.7(EETD 85)

6.0 POUR POINT (°C):

-27(MACKAY 82b)
-6, MAX (ASTM D 396)
-20(FINGAS 79)
-7(CURL 77)

7.0 FLASH POINT (°C):

104(MACKAY 82b)
38, MIN (ASTM D 396)
91(C.C.)(EETD 84)
52-96(EETD 84)
55(FINGAS 79)
38(CURL 77)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	VAPOUR TEMPERATURE	LIQUID TEMPERATURE
IBP	180 TO 360(FINGAS 79)	240(MACKAY 82b)
5		254(MACKAY 82b)
10		260(MACKAY 82b)
15		267(MACKAY 82b)
20		273(MACKAY 82b)
25		279(MACKAY 82b)
30		286(MACKAY 82b)
35		292(MACKAY 82b)
90	282 TO 338(ASTM D 396)	

10.0 EMULSION FORMATION TENDENCY & STABILITY: FORMS NO EMULSION (MACKAY 82b)

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 84)
15	0(EETD 84)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 84)
15	0(EETD 84)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 84)
15	N/M(EETD 84)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	61.8(PANCIROV 74)(ASTM D 2007)
AROMATICS	38.2(PANCIROV 74)(ASTM D 2007) 25(CURL 77)
POLARS	0(PANCIROV 74)
ASPHALTENES	0(PANCIROV 74) 0.36(MACKAY 82b)
PARAFFINS	30(CURL 77)
NAPHTHENES	45(CURL 77)

14.0 WAX CONTENT (WT %): 2.9(MACKAY 82b)

15.0 AQUEOUS SOLUBILITY (mg/L):

in freshwater @ 20°C:	3.12(MACKAY 82b)
diesel fuel in freshwater @ 22°C:	2.8(SUNTIO 86)
heating oil in freshwater @ 22°C:	0.3(SUNTIO 86)
in distilled water @ 5°C:	2.7(MAIJANEN 84)
in distilled water @ 20°C:	3.2(MAIJANEN 84)
in distilled water:	9.3(MURRAY 84)
in seawater @ 5°C:	2.05(MAIJANEN 84)
in seawater @ 20°C:	2.50(MAIJANEN 84)
in seawater:	8.7(ANDERSON 74)

16.0 TOXICITY:

ACUTE TOXICITY OF WATER SOLUBLE FRACTION (mg/L):

SPECIES	24 hour LC50	48 hour LC50	96 hour LC50
POLYCHAETA:			
NEANTHES ARENACEODENTATA	>8.7(ROSSI 76)	3.2(ROSSI 76)	2.7(ROSSI 76)
CAPITELLA CAPITATA	>8.7(ROSSI 76)	3.5(ROSSI 76)	2.3(ROSSI 76)
NEREIS VEXILLOSA			>3.36/>8.19(RICE 79)
CRUSTACEA:			
MYSIDOPSIS ALMYRA	2.6(ANDERSON 74)	0.9(ANDERSON 74)	
PALAEMONETES PUGIO	4.4(ANDERSON 74)	4.1(ANDERSON 74)	3.5(ANDERSON 74)
PENAEUS AZTECUS	5.0(ANDERSON 74)	5.0(ANDERSON 74)	4.9(ANDERSON 74)
LIGIA EXOTICA	>8.7(DILLON 78)	>8.7(DILLON 78)	>8.7(DILLON 78)
LUCIFER FAXONI	8.9(LEE 78)	4.6(LEE 78)	3.2(LEE 78)
ORCHOMENE PINGUIS			>1.74/>0.48(RICE 79)
ACANTHOMYSIS PSEUDOMACROPSIS			2.31/>0.45(RICE 79)
EUALUS SUCKLEYI			1.10/0.59(RICE 79)
CRANGON ALASKENSIS			0.36/0.43(RICE 79)
PARGURUS HIRSUITICULUS			>3.36/>8.19(RICE 79)
PARALITHODES CAMTSCHAYICA			1.02/0.81(RICE 79)

16.0 TOXICITY (continued):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION (mg/L) continued:

SPECIES	24 hour LC50	48 hour LC50	96 hour LC50
FISH:			
MENIDIA BERYLLINA	5.7(ANDERSON 74)	5.2(ANDERSON 74)	3.9(ANDERSON 74)
FUNDULUS SIMILIS	5.6(ANDERSON 74)	4.7(ANDERSON 74)	3.9(ANDERSON 74)
CYPRINODON VARIEGATUS	>6.9(ANDERSON 74)	>6.9(ANDERSON 74)	6.3(ANDERSON 74)
ONCORHYNCHUS GORBUSCHA			0.97/0.54(RICE 79)
SALVELINUS MALMA			0.15/0.72(RICE 79)
MYOXOCEPHALUS POLYACANTHOCEPHALUS			1.31/2.41(RICE 79)
PLATICTHYS STEELATUS			>0.97/>1.72(RICE 79)
PHOLIS LAETA			>0.92/>1.72(RICE 79)
MOLLUSKS:			
COLLISELLA SCUTUM			>3.36/>8.19(RICE 79)
CHLAMYS HERICUS			>3.36/>8.19(RICE 79)
KATHARINA TUNICATA			>3.36/>8.19(RICE 79)
MYTILUS EDULIS			>1.25/>4.19(RICE 79)
THAIS LIMA			>3.36/>8.19(RICE 79)
NEMERTEAN:			
PARANEMERTES PEREGRINA			>3.36/>8.19(RICE 79)
ECHINODERMS:			
LEPTASTERIAS HEXACTIS			>3.36/>8.19(RICE 79)

NOTE: FOR (RICE 79) THE FIRST NUMBER REPORTED IS TOTAL AROMATICS/THE SECOND NUMBER REPORTED IS TOTAL HYDROCARBONS MEASURED BY IR SPECTROPHOTOMETRY.

ACUTE TOXICITY OF OIL-IN-WATER DISPERSION (mg/L):

SPECIES	24 hour LC50	48 hour LC50	96 hour LC50
CRUSTACEA:			
MYSIDOPSIS ALMYRA	1.6(ANDERSON 74)	1.3(ANDERSON 74)	
PALAEMONETES PUGIO	3.8(ANDERSON 74)	3.4(ANDERSON 74)	3.0(ANDERSON 74)
PENAEUS AZTECUS	9.4(ANDERSON 74)	9.4(ANDERSON 74)	9.4(ANDERSON 74)
LIGIA EXOTICA	73.0(DILLON 78)	73.0(DILLON 78)	36.5(DILLON 78)
FISH:			
MENIDIA BERYLLINA	260(ANDERSON 74)	125(ANDERSON 74)	
FUNDULUS SIMILIS	48(ANDERSON 74)	36(ANDERSON 74)	33(ANDERSON 74)
CYPRINODON VARIEGATUS	250(ANDERSON 74)	200(ANDERSON 74)	93(ANDERSON 74)

COMBUSTION PRODUCT TOXICITY: NO GREAT HAZARD (OHMTADS 81)
POTENTIAL FOR ACCUMULATION: NEGATIVE (OHMTADS 81)
GENERAL EFFECT: INHALATION: HEADACHE & STUPOR (OHMTADS 81)

17.0 SULPHUR (WT %): 0.5, MAX (ASTM D 396)
0.32(PANCIROV 74)
0.36(EETD 86)
WINTER GRADE DIESEL: 0.16(EETD 86)

18.0 OTHERS:

18.1 AUTO-IGNITION POINT (°C): 257(OHMTADS 81)

18.2 BOILING POINT (°C): 232(OHMTADS 81)

18.3 BOILING RANGE (°C): 34 TO 185(CURL 77)

18.4 ODOUR THRESHOLD, MEDIUM (PPM): 0.082(OHMTADS 81)

18.5 COLOUR IN WATER: DARK BLUE PURPLE(OHMTADS 81)

18.6 NITROGEN CONTENT (WT %): 0.024(PANCIROV 74)

18.7 METALS (PPM): NICKEL:0.5(PANCIROV 74)
VANADIUM:1.5(PANCIROV 74)

18.8 COMPOSITIONAL ANALYSIS (WT %):

SATURATES:	
N-ALKANES(C_{10} TO C_{21})	8.07
ISO-ALKANES	22.3
1-RING CYCLOALKANES	17.5
2-RING CYCLOALKANES	9.4
3-RING CYCLOALKANES	4.5
AROMATICS:	
BENZENES	10.3
INDANS & TETRALINS	7.3
DINAPHTHENO BENZENES	4.6
NAPHTHALENE	0.2
METHYLNAPHTHALENES	2.1
DIMETHYLNAPHTHALENES	3.2
OTHER NAPHTHALENES	0.4
ACENAPHTHENES	3.8
ACENAPHTHALENES	5.4
BENZOTHIOPHENES	0.9(CLARK 77)

FUEL OIL NO.2 (TYPICAL HEATING FUEL OIL)

1.0 TYPE: Typical heating fuel oil.

2.0 API GRAVITY: 32.1(API 81)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.8641(API 81)

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C)
IBP	116
5	171
10	194
15	207
20	216
25	226
30	233
35	243
40	251
45	258
50	267
55	273
60	280
65	287
70	297
75	306
80	317
85	327
90	339
95	356
FBP	399(API 81)

NOTE: (API 81) DATA FROM SIMULATED DISTILLATION ASTM METHOD D 2887

FUEL OIL NO.2 (TYPICAL HEATING FUEL OIL)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	0.3(SUNTIO 86)
in fresh water:	55.97(MACLEAN 88)
in seawater:	50.92(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTIONS TO DAPHNIA MAGNA:

48 hour EC_{50}:	1.9(MACLEAN 88)
	0.01(BOBRA 88)
48 hour LC_{50}:	2.18(MACLEAN 88)
	0.01(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTIONS TO ARTEMIA SPP.:

48 hour EC_{50}:	8.35(MACLEAN 88)
	0.04(BOBRA 88)
48 hour LC_{50}:	11.16(MACLEAN 88)
	0.05(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 0.19(API 81)

18.0 OTHERS:

18.1 NITROGEN (WT %): 0.014(API 81)

18.2 METALS (PPM): NICKEL: <0.1 TO 0.1(API 84)
VANADIUM: 0.1 TO 0.2(API 81)

FUEL OIL NO.2 (HIGH AROMATIC CONTENT HEATING OIL)

1.0 TYPE: High aromatic content heating oil.

2.0 API GRAVITY: 33.7(API 81)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.8558(API 81)

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C)
IBP	138
5	181
10	199
15	210
20	219
25	227
30	235
35	245
40	253
45	261
50	269
55	275
60	282
65	288
70	297
75	305
80	316
85	325
90	336
95	352
FBP	387(API 81)

NOTE: (API 81) DATA FROM SIMULATED DISTILLATION ASTM METHOD D 2887

FUEL OIL NO.2 (HIGH AROMATIC CONTENT HEATING OIL)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.12(API 81)

18.0 OTHERS:

18.1 NITROGEN (WT %): 0.009(API 81)

18.2 METALS (PPM): NICKEL: 0.1(API 81)
VANADIUM: 0.1 TO 0.3(API 81)

FUEL OIL NO.4

1.0 TYPE: Fuel Oil No. 4.
It can be a high-boiling-distillate or a light residual of crude oil, or it can be prepared by blending 40% Fuel Oil No.2 and 60% Fuel Oil No.6. (Curl 77).

2.0 API GRAVITY (15/15°C): 24.9 TO 23.5(CURL 77)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.914 TO 0.922(CURL 77) 0.938(MACKAY 82b)
15	0.904 TO 0.912(CURL 77)
20	0.901 TO 0.909(CURL 77) 0.925(MACKAY 82b)
30	0.895 TO 0.902(CURL 77)

NOTE: (CURL 77) DATA OBTAINED FROM A GRAPH

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
10	47.2(MACKAY 82b)
20	22.7(MACKAY 82b)

FUEL OIL NO.4

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
10	40 TO 101(CURL 77)
15	33 TO 79(CURL 77)
20	27 TO 60(CURL 77)
30	18 TO 38(CURL 77)
38	5.8 TO 26.4(ASTM D 396) 2.0 TO 5.8 for No.4 Light(ASTM D 396)
40	11 TO 26(CURL 77)

NOTE: DATA OBTAINED FROM A GRAPH (CURL 77)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm): @ 20 °C: 32.1(MACKAY 82b)

5.2 OIL-SEAWATER (mN/m or dynes/cm): @ 20 °C: 30.23(MACKAY 82b)

6.0 POUR POINT (°C):
-7(CURL 77)
-3(MACKAY 82b)
-6, MAX (ASTM D 396)

7.0 FLASH POINT (°C):
54(CURL 77)
78(MACKAY 82b)
55, MIN (ASTM D 396)
38 for No.4 Light, MIN (ASTM D 396)

8.0 VAPOUR PRESSURE:

FUEL OIL NO.4

9.0 DISTILLATION DATA (^oC):

VOLUME PERCENT	LIQUID TEMPERATURE
IBP	245(MACKAY 82b)
5	257(MACKAY 82b)
10	269(MACKAY 82b)
15	281(MACKAY 82b)
20	293(MACKAY 82b)
25	305(MACKAY 82b)
30	317(MACKAY 82b)

10.0 EMULSION FORMATION TENDENCY & STABILITY: FORMS STABLE EMULSION (MACKAY 82b)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 3.2(MACKAY 82b)

14.0 WAX CONTENT (WT %): 5.5 (MACKAY 82b)

15.0 AQUEOUS SOLUBILITY (mg/L): @ 20°C: 6.46(MACKAY 82b)

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 AUTO-IGNITION TEMPERATURE (°C): 263(CURL 77)

FUEL OIL NO.5

1.0 TYPE: Fuel Oil No. 5, Navy Special or Bunker B Fuel Oil.
Can be prepared by adding 20 to 25% Fuel Oil No. 2 to 75 to 80% Fuel Oil No.6 (Curl 77).
Light Fuel Oil No.5 and Heavy Fuel Oil No.5 (Curl 77).

2.0 API GRAVITY: MINIMUM 11.5(NAVAL 77)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%)
	0
0	0.932 TO 0.957(CURL 77)
15	0.923 TO 0.948(CURL 77)
20	0.920 TO 0.945(CURL 77)
30	0.913 TO 0.938(CURL 77)

NOTE: DATA OBTAINED FROM A GRAPH (CURL 77)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	FUEL OIL No.5 LIGHT	FUEL OIL No.5 HEAVY
10	200 TO 473(CURL 77)	>473(CURL 77)
15	152 TO 313(CURL 77)	>313(CURL 77)
20	123 TO 233(CURL 77)	>233(CURL 77)
25	100 TO 165(CURL 77)	165 TO 327(CURL 77)
30	74 TO 125(CURL 77)	125 TO 200(CURL 77)
38	26.4 TO 65(ASTM D 396)	65 TO 194(ASTM D 396)
40	40 TO 75(CURL 77)	75 TO 100(CURL 77)

NOTE: DATA OBTAINED FROM A GRAPH (CURL 77)

FUEL OIL NO.5

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (^oC): -9.4, MAX (NAVAL 77)

7.0 FLASH POINT (^oC): >54(CURL 77)
60, MIN (NAVAL 77)
55, MIN (ASTM D 396)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

FULMAR CRUDE OIL

1.0 TYPE: Fulmar Crude Oil (UK, North Sea).

2.0 API GRAVITY (15/15°C): 39.3 (NSD 88)

3.0 DENSITY (g/mL): 0.8280 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 2.55 (AALUND 83c)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -12 (AALUND 83c)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.26 (AALUND 83c)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_4 AND LIGHTER		2.7
GASOLINE	C_5-85	19.5
NAPHTHA	85-165	19.5
KEROSINE	165-235	15.7
GAS OIL	235-300	12.2
GAS OIL	300-350	9.5
RESIDUE	350+	33.1

(AALUND 83c)

GASOLINE

1.0 TYPE: Automotive Gasoline. Data from reference (EETD 84/85) are based on automotive gasoline sample purchased from a service station in the summer 1984.

2.0 API GRAVITY:
60(FINGAS 79)
62.4(15/15°C)(EETD 84)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.746(EETD 84)
5	0.7501(MAIJANEN 84)
15	0.729(EETD 84)
20	0.7340(MAIJANEN 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	0.75(EETD 85)
5	0.53(MAIJANEN 84)
15	0.62(EETD 85)
20	0.45(MAIJANEN 84)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	0.69 to 0.95(CURL 77)
15	0.57 to 0.80(CURL 77)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	20.9(EETD 84)
15	19.8(EETD 84)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	19.8(EETD 84)
15	18.6(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	19.7(EETD 84)
15	18.0(EETD 84)

6.0 POUR POINT (°C): N/A(FINGAS 79)

7.0 FLASH POINT (^{o}C): -43(OHMTADS 81)
-43(CURL 77)
-40(FINGAS 79)

8.0 VAPOUR PRESSURE (kPa): 62 TO 103(ASTM D 439)

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (^{o}C)
10	50 TO 70(ASTM D 439)
50	77 TO 121(ASTM D 439)
90	185 TO 190(ASTM D 439)
FBP	225(ASTM D 439)
RESIDUE	2% MAX(ASTM D 439)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

PARAFFINS	50(CURL 77)
NAPHTHENES	40(CURL 77)
AROMATICS	10(CURL 77)

may contain up to 30% Alkenes (CURL 77)

GROUP	STRAIGHT-RUN	BLENDED
SATURATES	39.61	57.65
AROMATICS	46.24	32.56
OLEFINS	14.15	7.03
DIOLEFINS		2.48
BENZENE		0.28(WATERS 82)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L):

unleaded gasoline in fresh water @ 22°C:	112(SUNTIO 86)
unleaded gasoline in fresh water:	306.6(MACLEAN 88)
leaded gasoline in fresh water @ 22°C:	240(SUNTIO 86)
leaded gasoline in fresh water:	169(MACLEAN 88)
summer gasoline in distilled water @ 22°C:	98(MAIJANEN 84)
regular gasoline in distilled water:	186.7(MURRAY 84)
unleaded gasoline in seawater:	260.9(MACLEAN 88)
leaded gasoline in seawater:	132.4(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHIA MAGNA:

leaded gasoline, 48 hour EC_{50}:	6.25(MACLEAN 88)
	8.88(BOBRA 88)
unleaded gasoline, 48 hour EC_{50}:	4.91(MACLEAN 88)
	1.79(BOBRA 88)
leaded gasoline, 48 hour LC_{50}:	13.5(MACLEAN 88)
	19.2(BOBRA 88)
unleaded gasoline, 48 hour LC_{50}:	50.3(MACLEAN 88)
	18.4(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

leaded gasoline, 48 hour EC_{50}:	19.2(MACLEAN 88)
	27.8(BOBRA 88)
unleaded gasoline, 48 hour EC_{50}:	25.1(MACLEAN 88)
	8.6(BOBRA 88)
leaded gasoline, 48 hour LC_{50}:	21.3(MACLEAN 88)
	30.9(BOBRA 88)
unleaded gasoline, 48 hour LC_{50}:	51.4(MACLEAN 88)
	17.7(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO LARVAL RAINBOW TROUT (unleaded gasoline):

48 hour LC_{50} (closed container):	6.80(LOCKHART 87)
48 hour LC_{50} (open container):	5.40(LOCKHART 87)

48 hour LC_{50}, juvenile shad (freshwater):91(TAGATZ 61)

17.0 SULPHUR (WT %):

0.07(EETD 86)
unleaded grade: maximum, 0.10(ASTM D 439)
conventional grade: maximum, 0.15(ASTM D 439)

18.0 OTHERS:

18.1 LEAD CONTENT (g/L): unleaded grade: maximum, 0.013(ASTM D 439)
conventional grade: maximum, 1.1(ASTM D 439)

18.2 AUTO-IGNITION TEMPERATURE (°C): 280(OHMTADS 81)
257(CURL 77)

18.3 EXPLOSION LIMITS OF VAPOUR IN AIR: UPPER: 7.6 PERCENT(CURL 77)
LOWER: 1.4 PERCENT(CURL 77)

18.4 BOILING POINT (°C): 38(OHMTADS 81)
30 TO 200(FINGAS 79)

18.5 ODOUR THRESHOLD (PPM): UPPER: 0.01(OHMTADS 81)
LOWER: 0.005(OHMTADS 81)

18.6 COMPOSITIONAL ANALYSIS (WT %):

COMPOUND	Leaded	Unleaded	Super Unleaded
isobutane	1.561	2.241	1.180
n-hexane	11.04	11.13	12.93
unknown	ND	0.511	ND
n- & iso pentanes	8.320	8.936	6.144
2-pentane	8.942	6.149	2.461
unknown	0.199	2.657	1.677
1-pentane	2.235	2.959	1.948
2-methylpentane	6.322	5.392	4.325
3-methylpentane	3.353	2.634	1.873
unknown (MW=86)	4.030	1.912	1.488
2-ethyl-1-butene	1.149	1.813	0.997
unknown	ND	0.841	ND
methylcyclopentane	3.851	3.011	2.971
unknown (MW=100)	3.643	3.033	2.178
3-ethylpentane	2.736	1.857	1.410
isooctane	1.961	1.815	8.693
n-heptane	2.293	1.230	0.247
1-methyl-1-cyclohexane	1.022	1.368	0.199
benzene	3.879	3.238	4.352
unknown	0.355	0.367	ND
unknown (MW=114)	1.916	1.616	3.800
unknown (MW=114)	1.380	1.048	5.830
unknown	ND	ND	1.466
1,2-dimethylcyclohexane	0.643	0.550	0.203
2,4-dimethylheptane	1.801	1.300	0.631
unknown (MW=124)	0.466	0.511	0.426

18.6 COMPOSITIONAL ANALYSIS (continued):

COMPOUND	Leaded	Unleaded	Super Unleaded
toluene & 1,2-dichloroethane	4.457	4.792	5.966
4-methyloctane	0.766	0.669	0.516
4-n-propylheptane	0.536	0.451	0.543
n-nonane	0.796	0.663	0.402
ethylbenzene	1.239	1.357	1.450
p & m xylenes & 1,2-dibromomethane & phenylenediamine	3.985	4.751	5.166
3,4-dimethylheptane	0.114	0.104	0.038
o-xylene	1.571	1.856	2.244
2,6-dimethyloctane	0.266	0.266	0.015
n-propylbenzene	0.347	0.475	0.783
methyl ethyltoluene	1.723	2.251	3.033
cumene	1.118	1.354	1.897
1,2,4-trimethylbenzene & o-ethyltoluene	1.939	2.365	3.019
vinyl-2-ethyl hexyl ether	0.155	0.141	0.042
m-styrene & n-butylbenzene	1.403	1.736	1.586
dimethyl ethylbenzene	0.430	0.534	0.461
diethylbenzene	1.448	1.741	1.200
1,2,4,5-tetramethylbenzene	ND	ND	0.133
n-dodecane	0.574	0.757	0.216
1,1-dimethyl ethylbenzene	1.000	1.323	0.924
ethyl styrene	0.589	0.824	0.441
2,6-dimethyl styrene	0.971	1.369	0.822
unknown	0.596	0.964	0.451
dimethyl isopropylbenzene	0.356	0.520	0.327
2,6-dimethylundecane	0.185	0.229	0.520

(BRUELL 85)

GAS TURBINE FUEL OIL

1.0 TYPE: Gas Turbine Fuel Oil.
Grade 0-GT: Naphthas and others low flash distillates.
Grade 1-GT: Light distillates including some gas oil fractions.
Grade 2-GT: Heavier distillates than Grade 1-GT. Similar to No.2 fuel oil.
Grade 3-GT: Residual fuel that meets low ash requirements.
Grade 4-GT: Similar to Grade 3-GT but with no ash restrictions.(ASTM D 2880)

2.0 API GRAVITY: grade 1-GT: minimum, 35(ASTM D 2880)
grade 2-GT: minimum, 30(ASTM D 2880)

3.0 DENSITY (g/mL): @ 15°C: grade 1-GT: maximum, 0.850(ASTM D 2880)
grade 2-GT: maximum, 0.876(ASTM D 2880)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)			GRADE		
	0-GT	1-GT	2-GT	3-GT	4-GT
0	0.8 (DUKEK 78)	3.9 (DUKEK 78)	8.0 (DUKEK 78)	150 (DUKEK 78)	150 (DUKEK 78)
40		1.3-2.4 (ASTM D 2880)	1.9-4.1 (ASTM D 2880)	5.5min (ASTM D 2880)	5.5min (ASTM D 2880)
50				638max (ASTM D 2880)	638max (ASTM D 2880)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C):

grade 1-GT: maximum, -18(ASTM D 2880)
grade 2-GT: maximum, -6(ASTM D 2880)

7.0 FLASH POINT (°C):

grade 1-GT: maximum, 38(ASTM D 2880)
grade 2-GT: maximum, 38(ASTM D 2880)
grade 3-GT: maximum, 55(ASTM D 2880)
grade 4-GT: maximum, 66(ASTM D 2880)

8.0 VAPOUR PRESSURE:

GAS TURBINE FUEL OIL

9.0 DISTILLATION DATA:

VOLUME PERCENT	VAPOUR TEMPERATURE (°C)
90	grade 1-GT: 288, max(ASTM D 2880) grade 2-GT: 282 TO 338(ASTM D 2880)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

GORM CRUDE OIL

1.0 TYPE: Gorm Crude Oil (Denmark North Sea).

2.0 API GRAVITY (15/15°C): 33.9 (NSD 88)

3.0 DENSITY (g/mL): 0.8560 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 5.40 (AALUND 83c)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -37 (NSD 88)
-35 (AALUND 83c)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.23 (NSD 88)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_4 AND LIGHTER		1.6
LIGHT GASOLINE	C_5-149	19.7
NAPHTHA	149-204	10.0
KEROSINE	204-260	12.1
DIESEL OIL	260-343	15.9
GAS OIL	343-435	15.0
HEAVY GAS OIL	435-538	10.8
RESIDUUM	538+	14.9

(AALUND 83b)

GRANITE POINT CRUDE OIL

1.0 TYPE: Granite Point Crude Oil, Offshore Cook Inlet, Alaska.

2.0 API GRAVITY: 42.8(COLEMAN 78)

3.0 DENSITY (g/mL): @ 15.6°C: 0.812(COLEMAN 78)

4.0 VISCOSITY (Saybolt Universal seconds): @ 37.8 °C: 34(COLEMAN 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): <-15(COLEMAN 78)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

CUT TEMPERATURE (°C)	VOLUME PERCENT
27	IBP
50	6.0
75	9.1
100	17.7
125	27.1
150	33.5
175	40.0
200	45.1
225	50.6
250	56.1
275	63.3

(COLEMAN 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

GRANITE POINT CRUDE OIL

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.02(COLEMAN 78)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 1.1(COLEMAN 78)

18.2 NITROGEN (WT %): 0.039(COLEMAN 78)

18.3 COLOUR: BROWNISH GREEN(COLEMAN 78)

GULF ALBERTA L & M CRUDE OIL

1.0 TYPE: Gulf Alberta Light & Medium Crude Oil.

2.0 API GRAVITY: 35.1(AALUND 83a)

3.0 DENSITY (g/mL): @ 21 °C: 0.8486(AALUND 83a)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40 °C: 4.86 (AALUND 83a)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -27.5(AALUND 83a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 36.4(AALUND 83a)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (PPM): 9,800(AALUND 83a)

18.0 OTHERS:

18.1 H_2S (PPM): 58.1(AALUND 83a)

18.2 METALS (PPM): NICKEL: 10.10(AALUND 83a)
VANADIUM: 9.00(AALUND 83a)

18.3 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
NAPHTHA	C_5-190	30.60
KEROSINE	190-277	14.20
DISTILLATE	277-343	8.53
GAS OIL	343-565	31.43
RESIDUE	565+	15.2

(AALUND 83a)

GULLFAKS CRUDE OIL

1.0 TYPE: Gullfaks Crude Oil, Norway, North Sea.

2.0 API GRAVITY: 28.6(AALUND 83c)
29.3(CORBETT 90)

3.0 DENSITY (g/mL):

TEMP (^{o}C)	WEATHERING (VOLUME %) 0	8.4	18.0	27.7
15.5	0.882 (DALING 88)	0.893 (DALING 88)	0.905 (DALING 88)	0.914 (DALING 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (^{o}C)	WEATHERING (VOLUME %) 0	8.4	18.0	27.7
6	28 (DALING 88)	47 (DALING 88)	120 (DALING 88)	444 (DALING 88)
13	20 (DALING 88)	33 (DALING 88)	72 (DALING 88)	241 (DALING 88)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 37.8^{o}C: 10.14(AALUND 83c)
@20^{o}C: 16.5(CORBETT 90)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL:

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (^{o}C)	WEATHERING (VOLUME %) 0	8.4	18.0	27.7
13	13 (DALING 88)	13 (DALING 88)	15 (DALING 88)	17 (DALING 88)

GULLFAKS CRUDE OIL

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	<-34(DALING 88) -45(AALUND 83b) -57(CORBETT 90)
8.4	-26(DALING 88)
18.0	-15(DALING 88)
27.7	-9(DALING 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY: FRACTIONS WEATHERED (18.0, 27.7 VOLUME %) FORMED FAIRLY STABLE EMULSIONS (DALING 88).

10.3 WATER CONTENT OF STABLE EMULSIONS (VOLUME %):

TEMP (°C)		WEATHERING (VOLUME %)	
	8.4	18.0	27.7
13	UNSTABLE(DALING 88)	43.0(DALING 88)	69(DALING 88)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): For oil weathered 27.7 % by volume:

SATURATES	52.1
AROMATICS	40.0
POLARS	6.8
ASPHALTENES	1.0(DALING 88)

13.0 HYDROCARBON GROUP ANALYSIS (WT %) continued:

WEATHERING (VOLUME %)	ASPHALTENES "hard"	"soft"
0	0.02(DALING 88)	0.49(DALING 88)
8.4	0.02(DALING 88)	0.52(DALING 88)
18.0	0.03(DALING 88)	0.58(DALING 88)
27.7	0.03(DALING 88)	0.65(DALING 88)

14.0 WAX CONTENT (WT %):

WEATHERING (VOLUME %)	WAX CONTENT (WEIGHT %)
0	1.60(DALING 88)
8.4	1.72(DALING 88)
18.0	1.90(DALING 88)
27.7	2.14(DALING 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.44(AALUND 83c)(CORBETT 90)

18.0 OTHERS:

GULLFAKS CRUDE OIL

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %	WEIGHT %
GASOLINE	C_5-65	1.42	1.07
LIGHT NAPHTHA	65-90	1.76	1.46
NAPHTHA	90-150	9.18	8.08
NAPHTHA	150-180	5.06	4.62
HEAVY NAPHTHA	180-240	11.40	10.84
HEAVY NAPHTHA	240-320	16.64	16.54
GAS OIL	320-375	10.64	10.84
GAS OIL	375-420	4.44	4.60
HEAVY GAS OIL	420-525	20.97	22.01
HEAVY GAS OIL	525-565	4.69	5.00
RESIDUUM	565+	12.62	14.19

(CORBETT 90)

18.2 WATER CONTENT (VOL %): <0.05(CORBETT 90)

18.3 TOTAL ACID NO. (mg KOH/g): 0.23(CORBETT 90)

18.4 METALS (PPM): NICKEL: 1(CORBETT 90)
VANADIUM: 2(CORBETT 90)

18.5 SALT (PPM): 17(CORBETT 90)

HIBERNIA CRUDE OIL

1.0 TYPE: Hibernia Crude Oil.
Oil sample received from EPA Ohmsett, 1986.

2.0 API GRAVITY (15/15°C): 28.3(EETD 86)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOLUME %) 0	8.8	17.7
0	0.8970(EETD 86)	0.9131(EETD 86)	0.9246(EETD 86)
15	0.8849(EETD 86)	0.9011(EETD 86)	0.9138(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0	8.8	17.7
0	10,185(EETD 86)	110,500(EETD 86)	N/M(EETD 86)
15	44.2(EETD 86)	207(EETD 86)	1,471(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (VOLUME %) 0	8.8	17.7
0	11,354(EETD 86)	N/M(EETD 86)	N/M(EETD 86)
15	91.6(EETD 86)	229.7(EETD 86)	1,610(EETD 86)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.8	17.7
0	N/M(EETD 86)	N/M(EETD 86)	N/M(EETD 86)
15	26.2(EETD 86)	26.5(EETD 86)	27.0(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.8	17.7
0	N/M(EETD 86)	N/M(EETD 86)	N/M(EETD 86)
15	13.5(EETD 86)	16.7(EETD 86)	19.1(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.8	17.7
0	N/M(EETD 86)	N/M(EETD 86)	N/M(EETD 86)
15	16.2(EETD 86)	16.8(EETD 86)	20.9(EETD 86)

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	15(EETD 86)
8.8	18(EETD 86)
17.7	21(EETD 86)

HIBERNIA CRUDE OIL

7.0 FLASH POINT (^{o}C): -14(C.C)(EETD 86)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (^{o}C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	137	34.5
5	217	85
10	252	115
15	282	139
20	311	160
25	336	185
30	359	210
35	382	234
40	400	253
45	417	267
50	428	284
55	440	325
	(EETD 86)	(EETD 86)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (^{o}C)	0	WEATHERING (VOLUME %) 8.8	17.7
0	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)
15	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (^{o}C)	0	WEATHERING (VOLUME %) 8.8	17.7
0	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)
15	1.0(EETD 86)	0(EETD 86)	1.0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP ($^{\circ}$C)	WEATHERING (VOLUME %) 0	8.8	17.7
0	71.8(EETD 86)	47.1(EETD 86)	23.3(EETD 86)
15	88.5(EETD 86)	N/M(EETD 86)	65.0(EETD 86)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 8101\,\Theta\,\exp(6.3 - 4522.5/T_k)/T_k)}{(8101/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = $^{\circ}$C + 273)
(EETD 86)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	6
CRX-8	6
ENER 700	10
DASIC	14(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 4(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	82.1
AROMATICS	13.5
POLARS	2.0
ASPHALTENES	2.4(EETD 86)
ASPHALTENES	3.6(EETD 89)

HIBERNIA CRUDE OIL

14.0 WAX CONTENT (WT %): 1.1(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	23.3(SUNTIO 86)
in salt water @ 22°C:	18.7(SUNTIO 86)

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR CONTENT (WEIGHT %)
0	0.65(EETD 86)
8.8	0.64(EETD 86)

18.0 OTHERS:

HIBERNIA CRUDE OIL

1.0 TYPE: Hibernia Crude Oil.

2.0 API GRAVITY:

3.0 DENSITY (g/mL):

For Fv < 23.0 % & T between 0 and 15 °C:
DEN = 0.877086 + 0.001632 Fv - 0.000791 T
where: DEN is density of oil at T and Fv (g/mL)
Fv is volume percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	WEATHERING (VOLUME %) 0	18.2	23.0
0	0.8773(EETD 85) 0.843(MACKAY 82a)	0.9070(EETD 85)	0.9142(EETD 85)
5	0.841(MACKAY 82a)		
10	0.840(MACKAY 82a)		
15	0.8648(EETD 85) 0.839(MACKAY 82a)	0.8957(EETD 85)	0.9024(EETD 85)
20	0.827(MACKAY 82a)		
25	0.836(MACKAY 82a)		

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	18.2	23.0
0		94,000(EETD 86)	294,000(EETD 86)
5	148(MACKAY 82a)		
10	72.4(MACKAY 82a)		
15	49.0(MACKAY 82a)	270.5(EETD 86)	5,100(EETD 86)
20	33.2(MACKAY 82a)		
25	25.6(MACKAY 82a)		

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	18.2	23.0
0		N/M(EETD 86)	N/M(EETD 86)
15		302(EETD 86)	5,652(EETD 86)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	18.2	23.0
0	29.0(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	27.2(EETD 85)	28.8(EETD 85)	30.6(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	18.2	23.0
0	24.2(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	21.0(EETD 85)	19.5(EETD 85)	32.7(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	18.2	23.0
0	26.4(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	23.4(EETD 85)	22.0(EETD 85)	38.7(EETD 85)

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	12(EETD 85) 6(MACKAY 82a)
18.2	15(EETD 85)
23.0	18(EETD 85)

7.0 FLASH POINT (°C): -10 (C.C)(EETD 85)

8.0 VAPOUR PRESSURE:

HIBERNIA CRUDE OIL

9.0 DISTILLATION DATA:

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	147	43
5	175	99
10	206	120
15	238	138
20	270	171
25	297	199
	(EETD 85)	(EETD 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	18.2	23.0
0	1.0(EETD 86)	1.0(EETD 86)	0(EETD 86)
15	1.0(EETD 85)	1.0(EETD 86)	1.0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	18.2	23.0
0	1.0(EETD 86)	1.0(EETD 86)	0(EETD 86)
15	1.0(EETD 85)	1.0(EETD 86)	1.0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	18.2	23.0
0	75.0(EETD 86)	52.6(EETD 86)	N/A(EETD 86)
15	88.7(EETD 85)	75.3(EETD 86)	67.7(EETD 86)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 6143\,\theta\,\exp(6.3 - 4326/T_k)/T_k)}{(6143/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(EETD 85)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	79.3(MACKAY 82a)
AROMATICS	14.5(MACKAY 82a)
POLARS	3.52(MACKAY 82a)
ASPHALTENES	2.68(MACKAY 82a)

14.0 WAX CONTENT (WT %): 8.47 (MACKAY 82B)

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	23.3(SUNTIO 86)
in fresh water:	8.3(MACLEAN 88)
in salt water @ 22°C:	18.7(SUNTIO 86)
in seawater:	10.6(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

48 hour EC_{50}:	1.08(MACLEAN 88) 3.0(BOBRA 88)
48 hour LC_{50}:	5.49(MACLEAN 88) 15.4(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

48 hour EC_{50}:	6.34(MACLEAN 88) 11.1(BOBRA 88)
48 hour LC_{50}:	7.73(MACLEAN 88) 13.5(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY.
RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR:

18.0 OTHERS:

HUTTON CRUDE OIL

1.0 TYPE: Hutton Crude Oil (U.K)

2.0 API GRAVITY (15/15°C): 30.5 (NSD 88)

3.0 DENSITY (g/mL): 0.8730 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 10.9 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.65 (NSD 88)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 4.75 (NSD 88)

INTERPROVINCIAL CRUDE OIL

1.0 TYPE: Interprovincial Crude Oil (Canada).

2.0 API GRAVITY (15/15°C): 36.4 (NSD 88)

3.0 DENSITY (g/mL): 0.8430 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 4.80 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 2.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.42 (NSD 88)

18.0 OTHERS:

ISSUNGNAK CRUDE OIL

1.0 TYPE: Issungnak Crude Oil.

2.0 API GRAVITY (15/15°C): 35.0(EETD 86)

3.0 DENSITY (g/mL):

For Fv < 25.0 % & T between 0 and 15 °C:
DEN = 0.861749 + 0.001289 Fv - 0.001213 T
where: DEN is density of oil at T and Fv (g/mL)
Fv is volume percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	WEATHERING 0	4(%)	12(%)	15.1(vol%)	25.0(vol%)
0	0.8636 (EETD 85)			0.8806 (EETD 85)	0.8897 (EETD 85)
15	0.849 (EETD 84)			0.8682 (EETD 85)	0.8773 (EETD 85)
20	0.8284 (ESSO 83)	0.8459 (ESSO 83)	0.8469 (ESSO 83)		

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0	4	12
-10	DNF(ESSO 83)	DNF(ESSO 83)	DNF(ESSO 83)
0	199.4(ESSO 83)	DNF(ESSO 83)	DNF(ESSO 83)
15	3.652(ESSO 83)	6.008(ESSO 83)	6.248(ESSO 83)
25	3.005(ESSO 83)	4.564(ESSO 83)	4.566(ESSO 83)

NOTE: DNF = DID NOT FLOW

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	15.1	25.0
0	31.3(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	26.2(EETD 85)	27.7(EETD 85)	28.5(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	15.1	25.0
0	28.2(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	16.8(EETD 85)	17.0(EETD 85)	12.5(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	15.1	25.0
0	30.7(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	16.7(EETD 85)	23.4(EETD 85)	21.5(EETD 85)

6.0 POUR POINT (°C):

WEATHERING (%)	POUR POINT (°C)
0	5(ESSO 83)
4	6(ESSO 83)
12	7(ESSO 83)
15.1	11(EETD 85)
25.0	13(EETD 85)

7.0 FLASH POINT (°C):

WEATHERING (%)	FLASH POINT (°C)
0	-10(ESSO 83)
4	-16(ESSO 83)
12	48(ESSO 83)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT		WEATHERING (%)	
	0	4	12
INITIAL	5(ESSO 83)	38(ESSO 83)	83(ESSO 83)
50	254(ESSO 83)	276(ESSO 83)	283(ESSO 83)
FINAL	448(ESSO 83)	544(ESSO 83)	538(ESSO 83)
FINAL VOLUME	100 %(ESSO 83)	96 %(ESSO 83)	98 %(ESSO 83)

9.0 DISTILLATION DATA continued:

	WEATHERING (VOLUME %)			
	0		15.1	
VOLUME PERCENT	LIQIUD TEMP	VAPOUR TEMP	LIQUID TEMP	VAPOUR TEMP
IBP	175	59	230	129
5	189	112	244	152
10	212	126	259	164
15	237	145	274	174
20	256	164	285	224
25	270	207	296	232
30	283	229	309	233
35	295	237	(EETD 85)	(EETD 85)
40	305	255		
	(EETD 85)	(EETD 85)		

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

		WEATHERING (VOLUME %)	
TEMP (°C)	0	15.1	25.0
0	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)
15	0(EETD 85)	0.30(EETD 86)	1.0(EETD 86)

10.2 EMULSION STABILITY:

		WEATHERING (VOLUME %)	
TEMP (°C)	0	15.1	25.0
0	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)
15	0(EETD 85)	0.25(EETD 86)	0.40(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (^{o}C)	WEATHERING (VOLUME %) 0	15.1	25.0
0	90.0(EETD 86)	63.6(EETD 86)	86.7(EETD 86)
15	N/M(EETD 85)	66.7(EETD 86)	50.0(EETD 86)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 2736\ \Theta\ \exp(6.3 - 5181/T_k)/T_k)}{(2736/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = ^{o}C + 273)
(EETD 85)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	66
CRX-8	60
ENER 700	62
DASIC	51(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15^{o}C (% DISPERSED): 8(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	91.5
AROMATICS	2.7
POLARS	0.3
ASPHALTENES	0.4(EETD 86) 0.5(EETD 89)

ISSUNGNAK CRUDE OIL

14.0 WAX CONTENT (WT %): 1.2 (EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR CONTENT (WT %)
0	0.08(EETD 86)
15.1	0.07(EETD 86)
25.0	0.10(EETD 86)

18.0 OTHERS:

18.1 FIRE POINT (°C):

WEATHERING (%)	FIRE POINT (°C)
0	-10(ENGELHARDT 84)
4	-16(ENGELHARDT 84)
12	57(ENGELHARDT 84)

ISTHMUS BLEND CRUDE OIL

1.0 TYPE: Isthmus/Reforma/Cactus Reforma Blend Crude Oil, Mexico.

2.0 API GRAVITY: 33.0(McCASLIN 79)
32.7(PETRO-CAN 80)

3.0 DENSITY (g/mL): @ 15 °C: 0.861(PETRO-CAN 80)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
10	16.05(PETRO-CAN 80)
15.9	22.9(McCASLIN 79)
20	10.65(PETRO-CAN 80)
37.8	7.1(PEREZ 79)
39	6.81(McCASLIN 79)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -16(PEREZ 79)
-27(PETRO-CAN 80)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 22.8(McCASLIN 79)
38.6(PEREZ 79)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (VOLUME %):

PARAFFINS	12(McCASLIN 79)
AROMATICS	1.4(McCASLIN 79)
NAPHTHENES	3.6(McCASLIN 79)
ASPHALTENES	0.9(WT %)(PETRO-CAN 80)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.56(McCASLIN 79)
1.7(PEREZ 79)
1.61(PETRO-CAN 80)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 3.5(RAMSBOTTOM)(PEREZ 79)
4.2(PETRO-CAN 80)

18.2 METALS (PPM):		
	VANADIUM:	21.1(PEREZ 79), 30.0(PETRO-CAN 80)
	NICKEL:	3.0(PEREZ 79) 5.0(PETRO-CAN 80)

18.3 YIELD ON CRUDE:

	WT %	VOL %
GAS TO C_4	0.7	0.85
LT.DISTILLATE TO 149 °C	14.55	17.5
KEROSINE 149-232 °C	16.5	17.95
GAS OIL 232-342 °C	19.5	19.8
RESIDUE above 342 °C	48.75	43.9

(PETRO-CAN 80)

KOAKOAK O-22 CRUDE OIL

1.0 TYPE: Koakoak 0-22 Crude Oil, Beaufort Sea.

2.0 API GRAVITY: 28.1(DOME 84)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.8887(DOME 84)
@ 21 °C: 0.8858(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
20	19.98(DOME 84)
30	12.91(DOME 84)
40	8.890(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -48(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

KOAKOAK O-22A CRUDE OIL

1.0 TYPE: Koakoak 0-22A Crude Oil, Beaufort Sea.

2.0 API GRAVITY: 29.5(DOME 84)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.8785(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
20	10.323(DOME 84)
30	6.836(DOME 84)
40	5.022(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): <60(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

KOPANOAR CRUDE OIL

1.0 TYPE: Kopanoar Crude Oil, Beaufort Sea.

2.0 API GRAVITY: 25.7 (ENGLEHART 84)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (WT %) 0	3.7	11.6
16	0.8992 (ENGLELHARDT 84)	0.9002 (ENGELHARDT 84)	0.9012 (ENGELHARDT 84)
20	0.900 (MACKAY 80a)	0.901 (MACKAY 80a)	0.902 (MACKAY 80a)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (WT %) 0	3.7	11.6
0	57 (ENGELHARDT 84)	75 (ENGELHARDT 84)	104 (ENGELHARDT 84)
15	33 (ENGELHARDT 84)	41 (ENGELHARDT 84)	54 (ENGELHARDT 84)
25	17.5 (ENGELHARDT 84)	24 (ENGELHARDT 84)	30 (ENGELHARDT 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	-37(ENGELHARDT 84)
3.7	-28(ENGELHARDT 84)
11.6	-19(ENGELHARDT 84)

KOPANOAR CRUDE OIL

7.0 FLASH POINT (°C):

WEATHERING (WT %)	FLASH POINT (°C)
0	75(ENGELHARDT 84)
3.7	86(ENGELHARDT 84)
11.6	118(ENGELHARDT 84)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C): INITIAL BOILING POINT: 84(MACKAY 80a)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L):

WEATHERING (WT %)	AQUEOUS SOLUBILITY (mg/L)
0	10.4(MACKAY 80a)
3.7	8.9(MACKAY 80a)
11.6	3.0(MACKAY 80a)

KOPANOAR CRUDE OIL

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 FIRE POINT (^{o}C):

WEATHERING (WT %)	FIRE POINT (^{o}C)
0	85(MACKAY 80a)
3.7	98(MACKAY 80a)
11.6	125(MACKAY 80a)

KOPANOAR 2I-44 CRUDE OIL

1.0 TYPE: Kopanoar 2I-44 Crude Oil, Beaufort Sea.

2.0 API GRAVITY: 29.3(DOME 84)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.8685(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
20	12.60(DOME 84)
30	8.87(DOME 84)
40	6.774(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -21.6(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

KOPANOAR M-13 CRUDE OIL

1.0 TYPE: Kopanoar M-13 Crude Oil, Beaufort Sea.

2.0 API GRAVITY: 30.9(DOME 84)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.8939(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
10	61.4(DOME 84)
20	33.97(DOME 84)
30	21.67(DOME 84)
40	14.38(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 2.7(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

KOPANOAR M-13A CRUDE OIL

1.0 TYPE: Kopanoar M-13A Crude Oil, Beaufort Sea.

2.0 API GRAVITY: 26.7(DOME 84)

3.0 DENSITY (g/mL): @ 21 °C: 0.8938(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	219.8(DOME 84)
4.4	128.0(DOME 84)
10	74.85(DOME 84)
15.4	43.21(DOME 84)
20	40.12(DOME 84)
30	28.46(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -17.5(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

KOPANOAR M-13A CRUDE OIL

14.0 WAX CONTENT (WT %): 0.22 (DOME 84)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY

17.0 SULPHUR:

18.0 OTHERS:

KUPARUK CRUDE OIL

1.0 TYPE: Kuparuk Crude Oil, North Slope, Alaska. Blended with Sadlerochit Crude to produce North Slope Crude. Trans Alaska pipeline to Valdez terminal.

2.0 API GRAVITY: 23.0(AALUND 83)
28.2(COLEMAN 78)

3.0 DENSITY (g/mL): @ 15.6°C: 0.886(COLEMAN 78)
@ 21 °C: 0.9150(AALUND 83)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 15.6 °C: 79.98(AALUND 83)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -55(AALUND 83)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 17.88(AALUND 83)

9.0 DISTILLATION DATA (°C):

CUT TEMPERATURE (°C)	VOLUME PERCENT
69	IBP
100	3.3
125	9.2
150	12.4
175	17.1
200	21.8
225	26.2
250	31.6
275	38.0

(COLEMAN 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

KUPARUK CRUDE OIL

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.65(COLEMAN 78)
1.76(AALUND 83)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 7.37(AALUND 83)
5.5(COLEMAN 78)

18.2 METALS (PPM): NICKEL: 19(AALUND 83)
VANADIUM: 57(AALUND 83)

18.3 NITROGEN: 1,980 PPM(AALUND 83)
0.160 %(COLEMAN 78)

18.4 H_2S (mg/m^3): <361(AALUND 83)

18.5 COLOUR: BROWNISH BLACK(COLEMAN 78)

18.6 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
$<C_5$		2.12
LIGHT GASOLINE	C_5-65	1.60
NAPHTHA	65-193	14.5
DISTILLATE	193-343	26.9
RESIDUE	343+	56.0

(AALUND 83)

KUWAIT CRUDE OIL

1.0 TYPE: Kuwait Crude Oil.

2.0 API GRAVITY: 31.1(LYNCH 81)(HMSO 76)
31.4(PANCIROV 74)
31.2(NSD 88)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0	9	38.1
15	0.870(HMSO 76)		
16	0.8692(LYNCH 81)	0.895(CURL 77)	0.955(CURL 77)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (WT %) 0	15.1	19.5	26.7	33.0
10	19	97	163	865	2279

(LYNCH 81)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

@ 38°C: 10.0(NSD 88)
@ 50°C: 7.6(HMSO 76)(LYNCH 81)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -20(LYNCH 81)(HMSO 76)(WHEELER 78)
-18(NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

WEIGHT PERCENT	TEMP (°C)
8.3	5 TO 100(LYNCH 81)(HMSO 76)
9.1	100 TO 160(LYNCH 81)(HMSO 76)
12.4	160 TO 250(LYNCH 81)(HMSO 76)
16.0	250 TO 350(LYNCH 81)(HMSO 76)
54.2	>350(LYNCH 81)(HMSO 76)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

KUWAIT CRUDE OIL

13.0 HYDROCARBON GROUP ANALYSIS:

HYDROCARBON GROUP	WT %
NAPHTHA (up to 204 °C)	22.7(PANCIROV 74)
SATURATES	34.0(PANCIROV 74) 54.3(WATERS 82) 54.58(WATERS 82) 42.4(WATERS 82) 56.7(WATERS 82) 43.5(WATERS 82) 50.2(CLARK 77)
AROMATICS	34.2(PANCIROV 74) 25.7(WATERS 82) 30.06(WATERS 82) 40.4(WATERS 82) 24.3(WATERS 82) 41.6(WATERS 82) 28.4(CLARK 77)
POLARS	17.9(PANCIROV 74) 17.9(WATERS 82) 11.57(WATERS 82) 14.8(WATERS 82) 17.9(WATERS 82) 13.8(WATERS 82) 17.0(CLARK 77)
ASPHALTENES	3.5(PANCIROV 74) 2.6(WATERS 82) 3.5(WATERS 82) 1.1(WATERS 82) 3.5(CLARK 77) 1.45(LYNCH 81) 0.80(NSD 88)

14.0 WAX CONTENT (WT %):

5.5(LYNCH 81)
3.9(NSD 88)

15.0 AQUEOUS SOLUBILITY (mg/L):

In distilled water:	35.3(MURRAY 84)
In seawater:	21.72(ANDERSON 74)

KUWAIT CRUDE OIL

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.44(PANCIROV 74)
2.53(HMSO 76)
2.50(NSD 88)

18.0 OTHERS:

18.1 NITROGEN (WT %): 0.14(PANCIROV 74)

18.2 METALS (PPM):

18.2 METALS (PPM):	NICKEL:	7.7(PANCIROV 74)
	VANADIUM:	28(PANCIROV 74)

KUWAIT CRUDE OIL

1.0 TYPE: Kuwait Crude Oil.

2.0 API GRAVITY (15/15°C): 30.6(EETD 86)

3.0 DENSITY (g/mL):

TEMP (°C)	0	WEATHERING (VOLUME %) 9.6	20.9
0	0.8833(EETD 86)	0.9064(EETD 86)	0.9279(EETD 86)
15	0.8722(EETD 86)	0.8977(EETD 86)	0.9165(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	0	WEATHERING (VOLUME %) 9.6	20.9
0	89.5(EETD 86)	1,250(EETD 86)	29,000(EETD 86)
15	22.2(EETD 86)	55.5(EETD 86)	182(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	0	WEATHERING (VOLUME %) 9.6	20.9
0	72.0(EETD 86)	1,379(EETD 86)	31,254(EETD 86)
15	28.2(EETD 86)	61.8(EETD 86)	199(EETD 86)

KUWAIT CRUDE OIL

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (VOLUME %) 9.6	20.9
0	28.0(EETD 86)	29.6(EETD 86)	31.4(EETD 86)
15	27.8(EETD 86)	27.9(EETD 86)	30.5(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (VOLUME %) 9.6	20.9
0	13.4(EETD 86)	21.1(EETD 86)	24.5(EETD 86)
15	22.9(EETD 86)	18.2(EETD 86)	18.5(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (VOLUME %) 9.6	20.9
0	29.1(EETD 86)	24.8(EETD 86)	27.3(EETD 86)
15	28.6(EETD 86)	21.1(EETD 86)	27.0(EETD 86)

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-18(EETD 86)
9.6	- 9(EETD 86)
20.9	3(EETD 86)

KUWAIT CRUDE OIL

7.0 FLASH POINT (°C): <-25(C.C)(EETD 86)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	119	39
5	172	97
10	205	130
15	236	153
20	267	181
25	301	208
30	333	239
35	366	264
40	392	296
45	412	312
50	424	325
55	434	335
60	441	341
65	446	342
70	451	(EETD 86)
75	458	
	(EETD 86)	

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	9.6	20.9
0	1.0(EETD 86)	1.0(EETD 86)	0(EETD 86)
15	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0	9.6	20.9
0	1.0(EETD 86)	1.0(EETD 86)	0(EETD 86)
15	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0	9.6	20.9
0	90.0(EETD 86)	90.0(EETD 86)	N/M(EETD 86)
15	90.0(EETD 86)	90.0(EETD 86)	90.0(EETD 86)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 6870.5\ \theta \exp(6.3 - 1397/T_k)/T_k)}{(6870.5/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(EETD 86)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

KUWAIT CRUDE OIL

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR CONTENT (WT %)
9.6	2.69(EETD 86)
20.9	3.18(EETD 86)

18.0 OTHERS:

LAGO MEDIO CRUDE OIL

1.0 TYPE: Lago Medio Crude Oil, Venezuela.

2.0 API GRAVITY: 32.6(McCASLIN 79)
31.5(NSD 88)

3.0 DENSITY (g/mL):

DEN = 0.880 + 0.00167 Fv - 0.00056 T
Where: DEN is density at Fv & T (g/mL)
Fv is volume fraction weathered
T is oil temperature (°C)

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	0.880(EETD 84)	0.898(EETD 84)	0.906(EETD 84)
15	0.872(EETD 84)	0.891(EETD 84)	0.897(EETD 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	4355(EETD 84)	7800(EETD 84)	16500(EETD 84)
15	41.1(EETD 84)	83.6(EETD 84)	265(EETD 84)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	4949(EETD 84)	8686(EETD 84)	18212(EETD 84)
15	47.1(EETD 84)	93.8(EETD 84)	295(EETD 84)
38	9.2(NSD 88)		

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	N/M(EETD 84)	N/M(EETD 84)	N/M(EETD 84)
15	28.2(EETD 84)	27.5(EETD 84)	29.6(EETD 84)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	N/M(EETD 84)	N/M(EETD 84)	N/M(EETD 84)
15	12.4(EETD 84)	14.4(EETD 84)	17.1(EETD 84)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	N/M(EETD 84)	N/M(EETD 84)	N/M(EETD 84)
15	23.2(EETD 84)	23.7(EETD 84)	20.5(EETD 84)

6.0 POUR POINT (°C): -26(McCASLIN 79)

7.0 FLASH POINT (°C): 57(C.C.)(EETD 84)

8.0 VAPOUR PRESSURE (kPa): 15.5(EETD 84)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	0.9(EETD 84)	1.0(EETD 84)	1.0(EETD 84)
15	1.0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	0.92(EETD 84)	0.9(EETD 84)	1.0(EETD 84)
15	1.0(EETD 85)	1.0(EETD 85)	1.0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	8.9	14.8
0	89.1(EETD 84)	84.9(EETD 84)	73.4(EETD 84)
15	88.5(EETD 85)	87.2(EETD 85)	86.1(EETD 85)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 6334.5\ \theta\ \exp(6.3 - 4717.4/T_k)/T_k)}{(6334.5/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(Stiver 82)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	5
CRX-8	5
ENER 700	13
DASIC	15(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 4(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 4.53(EETD 89)

14.0 WAX CONTENT (WT %): 1.43(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

WEATHERING (WT %)	SOLUBILITY (mg/L)
0	25.5(BOBRA 83)
22.3	0.61(BOBRA 83)

in fresh water @ 22°C: 8.40(SUNTIO 86)
in fresh water: 12.10(MACLEAN 88)
in seawater: 9.79(MACLEAN 88)

NOTE: SOLUBILITY RESULTS FOR (BOBRA 83) ARE IN DOUBLE DISTILLED WATER @ ROOM TEMPERATURE.

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

WEATHERING (WT %)	48 hour LC_{50} (mg/L)	48 hour EC_{50} (mg/L)
0	7.7(BOBRA 83) >24.1(MACLEAN 88) >8.4(BOBRA 88)	3.22(MACLEAN 88) 2.2(BOBRA 88)
21.3	>0.6(BOBRA 83)	

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

48 hour EC_{50}:	8.68(MACLEAN 88) 6.0(BOBRA 88)
48 hour LC_{50}:	9.79(MACLEAN 88) 6.7(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 1.23(McCASLIN 79)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 4.36(McCASLIN 79)

18.2 NICKEL/VANADIUM RATIO: 10.23 (NSD 88)

LAGOTRECO CRUDE OIL

1.0 TYPE: Lagotreco Crude Oil.
1961 Production sample from Bachaquero/Puerto
Miranda export terminal.

2.0 API GRAVITY: 27.3(PETRO-CAN 72)

3.0 DENSITY (g/mL): @ 15 °C: 0.891(PETRO-CAN 72)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

@ 21 °C: 34.8(PETRO-CAN 72)
@ 38 °C: 17.5(PETRO-CAN 72)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -48(PETRO-CAN 72)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 2.0(PETRO-CAN 72)

14.0 WAX CONTENT (WT %): 5.2 (PETRO-CAN 72)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.41(PETRO-CAN 72)

LAGOTRECO CRUDE OIL

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 5.3(PETRO-CAN 72)

18.2 ASH (WT %): 0.026(PETRO-CAN 72)

18.3 SALT (lb/1000 bbl): 3(PETRO-CAN 72)

18.4 WATER (VOL %): 0.5(PETRO-CAN 72)

18.5 METALS (PPM): VANADIUM: 127(PETRO-CAN 72)
NICKEL: 12(PETRO-CAN 72

18.6 H_2S (WT %): NIL(PETRO-CAN 72)

18.7 YIELD ON CRUDE:

	WT %	VOL %
GAS	0.34	0.48
BUT. GASOLINE TO 149 °C	11.22	13.62
KEROSINE 149-232 °C	11.21	12.38
GAS OIL 232-343 °C	19.16	19.76
RESIDUE above 343 °C	58.07	53.76

(PETRO-CAN 72)

LA ROSA CRUDE OIL

1.0 TYPE: La Rosa Crude Oil.

2.0 API GRAVITY: 25.3(NELSON 69)(NSD 88)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.923(MACKAY 82a)
5	0.921(MACKAY 82a)
10	0.917(MACKAY 82a)
15	0.914(MACKAY 82a)
20	0.911(MACKAY 82a)
25	0.908(MACKAY 82a)

NOTE: DEN = 0.923 - 0.000617 T
WHERE: DEN IS THE DENSITY OF FRESH OIL AT T (g/mL)
T IS OIL TEMPERATURE (°C)(MACKAY 82a)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	640(MACKAY 82a)
5	423(MACKAY 82a)
10	282(MACKAY 82a)
15	180(MACKAY 82a)
20	135(MACKAY 82a)
25	104(MACKAY 82a)

NOTE: VISC = exp((6040/(T+273)) - 15.7)
WHERE: VISC IS THE VISCOSITY OF FRESH OIL AT T (mPa.s)
T IS OIL TEMPERATURE (°C) (MACKAY 82a)

LA ROSA CRUDE OIL

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	693(MACKAY 82a)
5	459(MACKAY 82a)
10	308(MACKAY 82a)
15	197(MACKAY 82a)
20	148(MACKAY 82a)
25	115(MACKAY 82a)
50	24(NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -30(MACKAY 82a)
-46 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARON GROUP ANALYSIS (WT %):

SATURATES	66.1
AROMATICS	23.2
POLARS	4.48
ASPHALTENES	6.23(MACKAY 82a)

LA ROSA CRUDE OIL

14.0 WAX CONTENT (WT %): 9.9 (MACKAY 82a)

15.0 AQUEOUS SOLUBILITY (mg/L): in seawater: 19.97(McAULIFFE 77)

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.76(NELSON 69)
1.73(NSD 88)

18.0 OTHERS:

LEDUC WOODBEND CRUDE OIL

1.0 TYPE: Leduc Woodbend Crude Oil (Canada).

2.0 API GRAVITY (15/15°C): 39.7 (NSD 88)

3.0 DENSITY (g/mL): 0.8270 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 4.0 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.28 (NSD 88)

18.0 OTHERS:

LIGHT SOUR BLEND CRUDE OIL

1.0 TYPE: IPPL Light Sour Blend.
Blend of light, moderately low sulphur crudes
from fields in Saskatchewan. Sample from pipeline
blend delivered to Trafalgar Refinery, September 1970.

2.0 API GRAVITY: 35.9(PETRO-CAN 70)

3.0 DENSITY (g/mL): @ 20 °C: 0.8415(PETRO-CAN 70)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

@ 21 °C: 6.80(PETRO-CAN 70)
@ 38 °C: 4.13(PETRO-CAN 70)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -12(PETRO-CAN 70)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 1.0(PETRO-CAN 70)

14.0 WAX CONTENT (WT %): 6.2 (PETRO-CAN 70)

15.0 AQUEOUS SOLUBILITY (mg/L): in distilled water: 72.1(MURRAY 84)

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.0(PETRO-CAN 70)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 2.9(PETRO-CAN 70)

18.2 METALS (PPM):	VANADIUM:	7(PETRO-CAN 70)
	NICKEL:	5(PETRO-CAN 70)

18.3 WATER (WT %): <0.01(PETRO-CAN 70)

18.4 H_2S (WT %): 0.02(PETRO-CAN 70)

18.5 YIELD ON CRUDE:

	WT %	VOL %
GAS	0.95	1.20
BUT. GASOLINE TO 149 °C	21.40	24.95
KEROSINE 149-232 °C	14.80	15.60
GAS OIL 232-343 °C	21.20	20.95
RESIDUE above 343 °C	41.65	37.30

(PETRO-CAN 70)

LLOYDMINSTER CRUDE OIL

1.0 TYPE: Lloydminster Crude Oil, Alberta and Saskatchewan.

2.0 API GRAVITY: 20.7(AALUND 83a)

3.0 DENSITY (g/mL): @ 21 °C: 0.9289(AALUND 83a)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40 °C: 101.00(AALUND 83a)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -32.0(AALUND 83a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 30.3(AALUND 83a)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (PPM): 31,500(AALUND 83a)

18.0 OTHERS:

18.1 CON. CARBON (WT %): 9.18(AALUND 83a)

18.2 METALS (PPM): NICKEL: 52.70(AALUND 83a)
VANADIUM: 10.50(AALUND 83a)

18.3 YIELD ON CRUDE:

	RANGE, °C	VOL %
NAPHTHA	C_5-190	19.50
KEROSINE	190-277	9.80
DISTILLATE	277-343	9.50
GAS OIL	343-565	25.20
RESIDUE	565 +	36.00

(AALUND 83a)

LLOYDMINSTER CRUDE OIL

1.0 TYPE: Lloydminster Crude Oil.

2.0 API GRAVITY: 16.2(NELSON 69)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (WT %) 0	10	20
0	0.910 (MACKAY 82a)		
5	0.908 (MACKAY 82a)		
10	0.906 (MACKAY 82a)		
15	0.902 (MACKAY 82a)		
20	0.900 (MACKAY 82a)	0.923 (MACKAY 82a)	0.937 (MACKAY 82a)
25	0.897 (MACKAY 82a)		

NOTES: 0.90 @ ROOM TEMP (TWARDUS 80)

DEN = 0.910 - 0.00053 T
WHERE: DEN IS DENSITY OF FRESH OIL AT T (g/ml)
T IS OIL TEMPERATURE (°C) (MACKAY 82a)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	180(MACKAY 82a) 126(TWARDUS 80)
5	113(MACKAY 82a)
10	80.1(MACKAY 82a) 86.1(TWARDUS 80)
15	62.7(MACKAY 82a)
20	47.6(MACKAY 82a) 52.3(TWARDUS 80)
25	35.6(MACKAY 82a)

NOTE: VISC = EXP((5100/(T+273)) - 13.6)
WHERE: VISC IS THE VISCOSITY OF FRESH OIL AT T (mPa.s)
EXP IS EXPONENTIAL BASE e
T IS OIL TEMPERATURE (°C)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	198(MACKAY 82a)
5	124(MACKAY 82a)
10	88.4(MACKAY 82a)
15	69.5(MACKAY 82a)
20	52.9(MACKAY 82a)
25	39.7(MACKAY 82a)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm): @ ROOM TEMP: 25(TWARDUS 80)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

5.3 OIL-WATER (mN/m or dynes/cm): @ ROOM TEMP: 31.2(TWARDUS 80)

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	-36(MACKAY 82a) -52(TWARDUS 80)
10	-36(MACKAY 82a)
20	-21(MACKAY 82a)

7.0 FLASH POINT (°C): 11(O.C.)(TWARDUS 80)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMP (°C)
0	40
10	110
20	190
30	260
40	290
50	335
60	345
70	356
80	371
90	380

(TWARDUS 80)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

GROUP	WEATHERING (WT %) 0	10	20
SATURATES	68.4	66.0	62.7
AROMATICS	22.3	22.2	24.0
POLARS	3.75	3.18	3.36
ASPHALTENES	5.58	8.68	9.87

(MACKAY 82a)

14.0 WAX CONTENT (WT %):

WEATHERING (WT %)	WAX (WT %)
0	5.47(MACKAY 82a)
10	9.36(MACKAY 82a)
20	11.1(MACKAY 82a)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 IN-SITU COMBUSTION OF FRESH OIL: EASILY IGNITED, 6.1 VOL% RESIDUE(TWARDUS 80)

18.2 FIRE POINT (°C): 17(TWARDUS 80)

LUBRICATING OIL (EXTREME PRESSURE GEAR OIL)

1.0 TYPE: Extreme Pressure Gear Lubricating Oil.
API 6L-5 service. SAE 140.

2.0 API GRAVITY: 14, 22, 25(ESSO 73)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.8925(EETD 86)
15	0.8827(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	4,060(EETD 86)
15	975(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	4,549(EETD 86)
15	1,104(EETD 86)
37.8	432, 442, 710, 780(ESSO 73)
98.9	25 to 42.7(ESSO 73)

LUBRICATING OIL (EXTREME PRESSURE GEAR OIL)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	30.1(EETD 86)
15	29.7(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	3.6(EETD 86)
15	2.8(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	4.2(EETD 86)
15	3.4(EETD 86)

6.0 POUR POINT (°C): -7, -9, -15(ESSO 73)

7.0 FLASH POINT (°C): 193, 199, 266(ESSO 73)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

LUBRICATING OIL (EXTREME PRESSURE GEAR OIL)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	1.0(EETD 86)
15	1.0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	1.0(EETD 86)
15	1.0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	30.6(EETD 86)
15	57.9(EETD 86)

11.0 WEATHERING:

LUBRICATING OIL (EXTREME PRESSURE GEAR OIL)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED): OIL TO DISPERSANT RATIO : 20 TO 1.

TEMP (°C)	WEATHERING (%) 0
0	84.1(EETD 86)
15	59.9(EETD 86)

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

TEMP (°C)	WEATHERING (%) 0
0	23.6(EETD 86)
15	21.6(EETD 86)

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.41(EETD 89)

14.0 WAX CONTENT (WT %): 1.64(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	0.8(SUNTIO 86)
in fresh water:	2.3(MACLEAN 88)
in seawater:	1.66(MACLEAN 88)

LUBRICATING OIL (EXTREME PRESSURE GEAR OIL)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHIA MAGNA:

48 hour EC_{50}:	0.92(MACLEAN 88) 0.31(BOBRA 88)
48 hour LC_{50}:	>2.38(MACLEAN 88) >0.80(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

48 hour EC_{50}:	>1.66(MACLEAN 88) >0.64(BOBRA 88)
48 hour LC_{50}:	>1.66(MACLEAN 88) >0.64(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 1.10(EETD 86)

18.0 OTHERS:

LUBRICATING OIL (VIRGIN CRANKCASE OIL)

1.0 TYPE: Virgin Crankcase Lubricating oil.
Virgin Motor oil 10W30.

2.0 API GRAVITY: 29(ESSO 73)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.8892(EETD 86)
15	0.8784(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
-28.9	20,000 to 30,500(ESSO 73)
-17.8	1,200 to 4,100(ESSO 73)
0	727.4(EETD 86)
15	224.5(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	818.0(EETD 86)
15	255.6(EETD 86)
37.8	79 to 86(ESSO 73)
98.9	9.6 to 12.9(EESO 73)

LUBRICATING OIL (VIRGIN CRANKCASE OIL)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	30.2(EETD 86)
15	29.9(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	18.2(EETD 86)
15	16.6(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	19.8(EETD 86)
15	18.6(EETD 86)

6.0 POUR POINT (°C): -37(EESO 73)

7.0 FLASH POINT (°C): 199(COC)(ESSO 73)
188(COC)(ESSO 73)

8.0 VAPOUR PRESSURE:

LUBRICATING OIL (VIRGIN CRANKCASE OIL)

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	377	157
5	397	336
10	400	351
15	402	355
20	404	356
25	405	358
30	407	360
35	409	361
40	411	362
45	414	363
50	417	364
55	419	365
60	422	366
65	426	367
70	430	368
75	434	369
80	439	370
	(EETD 86)	(EETD 86)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	1.0(EETD 86)
15	1.0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	1.0(EETD 86)
15	0.89(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	58.6(EETD 86)
15	72.2(EETD 86)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED): OIL TO DISPERSANT RATIO : 20 TO 1.

TEMP (°C)	WEATHERING (%) 0
0	82.2(EETD 86)
15	69.7(EETD 86)

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

TEMP (°C)	WEATHERING (%) 0
0	4.7(EETD 86)
15	0(EETD 86)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	73.7
AROMATICS	25.4
POLARS	0.9
ASPHALTENES	0(WATERS 78)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L):

In fresh water @ 22°C: 0.2(SUNTIO 86)
In fresh water: 0.99(MACLEAN 88)
In seawater: 1.43(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHIA MAGNA:
48 hour EC_{50}: 0.30(MACLEAN 88)
0.04(BOBRA 88)
48 hour LC_{50}: 0.38(MACLEAN 88)
0.05(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:
48 hour EC_{50}: 0.08(MACLEAN 88)
0.008(BOBRA 88)
48 hour LC_{50}: 0.44(MACLEAN 88)
0.049(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 0.37(EETD 86)

18.0 OTHERS:

18.1 COLOUR: 3.0, 4.0(ESSO 73)

LUBRICATING OIL (USED CRANKCASE OIL)

1.0 TYPE: Used crankcase lubricating oil.
Used motor oil 10W30.

2.0 API GRAVITY (15/15°C): 28.3(EETD 86)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.8945(EETD 86)
15	0.8848(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	452.1(EETD 86)
15	175.2(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	505.4(EETD 86)
15	198.0(EETD 86)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	31.6(EETD 86)
15	31.0(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	24.2(EETD 86)
15	21.0(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	27.1(EETD 86)
15	24.4(EETD 86)

6.0 POUR POINT (°C): -36(EETD 86)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	1.0(EETD 86)
15	1.0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	1.0(EETD 86)
15	0.70(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	57.9(EETD 86)
15	72.8(EETD 86)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	33
CRX-8	31
ENER 700	36
DASIC	29(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 17(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	86.3
AROMATICS	12.9
POLARS	0.8
ASPHALTENES	0(WATERS 78)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	0.6(SUNTIO 86)
in fresh water:	19.1(MACLEAN 88)
in seawater:	12.83(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHIA MAGNA:
48 hour EC_{50}: 4.65(MACLEAN 88)
0.15(BOBRA 88)
48 hour LC_{50}: 4.87(MACLEAN 88)
0.16(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:
48 hour EC_{50}: >12.8(MACLEAN 88)
>0.48(BOBRA 88)
48 hour LC_{50}: >12.8(MACLEAN 88)
>0.48(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 0.29(EETD 86)

18.0 OTHERS:

MAGNUS CRUDE OIL

1.0 TYPE: Magnus Crude Oil (UK North Sea). Contributor to Ninian system to Sullom Voe, Shetland Islands. (Aalund 83c)

2.0 API GRAVITY (15/15°C): 39.3 (AALUND 83c)

3.0 DENSITY (g/mL):

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @21.1°C: 4.56 (AALUND 83c)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -3 (AALUND 83c)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.28 (AALUND 83c)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 2.00 (NSD 88)

18.2 YIELD ON CRUDE:

	RANGE, °C	WEIGHT %	VOLUME %
C_1-C_4		3.15	
GASOLINE	C_5-95	9.8	
NAPHTHA	95-175	16.75	
NAPHTHA	C_5-149	21.45	24.25
KEROSINE	149-232	15.0	15.5
GAS OIL	232-342	21.4	20.9
GAS OIL	342-369	4.4	4.15
GAS OIL	369-509	21.15	19.45
RESIDUE	342+	39.0	35.15
RESIDUE	509+	13.45	11.55

(AALUND 83c)

MARINE DIESEL FUEL OIL

1.0 TYPE: Marine Diesel Fuel Oil (MDO).
MDO is a heavy gas oil usually used for marine purposes only. Typically used by medium speed and medium/high speed marine diesel engines. Also used in the larger slow speed and medium speed propulsion engines which normally burn residual fuel but which start up and manoeuvre on distillate fuel (Clark 88).
Data from Clark (1988) are for a typical straight-run, all distillate Marine Diesel Fuel of Venezuelan origin. Data from (Burnett 85) are mean values for worldwide samples of commercial marine fuels.

2.0 API GRAVITY: 31.3(BURNETT 85)

3.0 DENSITY: @15°: 0.862(CLARK 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40°C: 7.3(CLARK 88)
6.1(BURNETT 85)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -15(CLARK 88)
-5(BURNETT 85)

7.0 FLASH POINT (°C): 82.2 (C.C)(CLARK 88)
98.3(BURNETT 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	TEMPERATURE (°C)
IBP	201(CLARK 88) 185.6(BURNETT 85)(ASTM D 86)
50	314(CLARK 88)
FBP	>380(CLARK 88) 426.7(BURNETT 85)(ASTM D 86)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

AROMATICS: 43.3(BURNETT 85)
ASPHALTENES: 0.01(BURNETT 85)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.92(CLARK 88)
1.12(BURNETT 85)

18.0 OTHERS:

18.1 CETANE NUMBER: 38(CLARK 88)

18.2 DIESEL INDEX: 43(CLARK 88)

18.3 ASH (WT %): 0.01(BURNETT 85)

18.4 METALS (PPM):

COPPER	0.4
SODIUM	1.2
CALCIUM	0.8
VANADIUM	5(BURNETT 85)

MARINE GAS OIL

1.0 TYPE: Marine Gas Oil Fuel.
Note: Data from (Burnett 85) are mean values for worldwide samples of commercial marine fuels.

2.0 API GRAVITY: 34.2(BURNETT 85)

3.0 DENSITY:

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/s or cSt): @ 40°C: 3.71(BURNETT 85)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -11(BURNETT 85)

7.0 FLASH POINT (°C): 81.1(BURNETT 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)
IBP	204
FBP	365

(BURNETT 85)
(ASTM D 86)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

AROMATICS:	38.2(BURNETT 85)
ASPHALTENES:	0.00(BURNETT 85)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.42(BURNETT 85)

18.0 OTHERS:

18.1 CLOUD POINT (°C): -1(BURNETT 85)

18.2 METALS (PPM):

COPPER	0.4
SODIUM	1.2
CALCIUM	0.8
VANADIUM	<5(BURNETT 85)

18.3 APPEARANCE: CLEAR AND BRIGHT(BURNETT 85)

18.4 ANILINE POINT (°C): 68.2(BURNETT 85)

18.5 ASH (WT %): 0.02(BURNETT 85)

MARINE GAS OIL (HEAVY)

1.0 TYPE: Heavy Marine Gas Oil Fuel.
Note: Data from (Burnett 85) are mean values for worldwide samples of commercial marine fuels.

2.0 API GRAVITY: 32.0(BURNETT 85)

3.0 DENSITY:

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/s or cSt): @ 40°C: 5.8(BURNETT 85)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -4(BURNETT 85)

7.0 FLASH POINT (°C): 99(BURNETT 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)
IBP	218
FBP	384

(BURNETT 85)
(ASTM D 86)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

AROMATICS:	40.6(BURNETT 85)
ASPHALTENES:	0.00(BURNETT 85)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

MARINE GAS OIL (HEAVY)

17.0 SULPHUR (WT %): 0.5(BURNETT 85)

18.0 OTHERS:

18.1 METALS (PPM):

COPPER	0.4
SODIUM	1.1
CALCIUM	0.9
VANADIUM	<5(BURNETT 85)

18.2 ANILINE POINT (°C): 67.3(BURNETT 85)

18.3 ASH (WT %): 0.02(BURNETT 85)

MARINE INTERMEDIATE FUEL OIL

1.0 TYPE: Marine Intermediate Fuel Oil.
Note: Data from (Burnett 85) are mean values for worldwide samples of commercial marine fuels.
EETD 89 data are for Interfuel 380 sample received from Irving Oil, St.John, N.B.

2.0 API GRAVITY: 14.6(BURNETT 85)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	0.9907 (EETD 89)
5	0.9872 (EETD 89)
10	0.9827 (EETD 89)
15	0.9787 (EETD 89)
20	0.9752 (EETD 89)
25	0.9712 (EETD 89)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	64000 (EETD 89)
5	31450 (EETD 89)
10	16000 (EETD 89)
15	8200 (EETD 89)
20	5250 (EETD 89)
25	4000 (EETD 89)

MARINE INTERMEDIATE FUEL OIL

4.2 KINEMATIC VISCOSITY (mm^2/s or cSt): @ 40°C: 198(BURNETT 85)
@ 100°C: 25.0(BURNETT 85)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
15	33.6 (EETD 89)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
15	35.5 (EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0
15	N/M(EETD 89)

6.0 POUR POINT (°C): 6(BURNETT 85)

7.0 FLASH POINT (°C): 83.9(BURNETT 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (VOLUME %) 0
15	0(EETD 89)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0
15	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0
15	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

WEATHERING (WEIGHT %)	ASPHALTENE CONTENT (WEIGHT %)
0	10.3(BURNETT 85) 6.2(EETD 89)
12.5	9.9(EETD 89)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (WEIGHT %)	SULPHUR CONTENT (WEIGHT %)
0	2.7(BURNETT 85) 2.6(EETD 89)
12.5	2.6(EETD 89)

18.0 OTHERS:

18.1 METALS (PPM):

COPPER	0.5
SODIUM	33
CALCIUM	15
VANADIUM	150(BURNETT 85)

18.2 ASH (WT %): 0.04(BURNETT 85)

MAUREEN CRUDE OIL

1.0 TYPE: Maureen Crude Oil (UK, North Sea).

2.0 API GRAVITY (15/15°C): 35.8 (AALUND 83c)

3.0 DENSITY :

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 7.0 (AALUND 83c)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.55 (AALUND 83c)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1 - C_4		2.6
NAPHTHA	15.5-204	27.9
KEROSINE	204-260	12.3
GAS OIL	260-343	15.6
TOPPED CRUDE	343+	41.6

(AALUND 83c)

MAYA CRUDE OIL

1.0 TYPE: Maya Crude Oil, Mexico.
Sample from Cantarell complex, Gulf of Campeche.
Sample received August 1980 from Ashland Oil,Inc.

2.0 API GRAVITY: 21.7(PETRO-CAN 81)
22(NSD 88)

3.0 DENSITY (g/mL): @ 15 °C: 0.923(PETRO-CAN 81)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

@ 10 °C:	522(PETRO-CAN 81)
@ 20 °C:	267(PETRO-CAN 81)
@ 20 °C:	222(NSD 88)
@ 40 °C:	69.8(PETRO-CAN 81)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -15(PETRO-CAN 81)
-18(NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 8.5(PETRO-CAN 81)

14.0 WAX CONTENT (WT %): 2(PETRO-CAN 81)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 3.40(PETRO-CAN 81)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 11.6(PETRO-CAN 81)

18.2 METALS (PPM): VANADIUM: 271(PETRO-CAN 81)
NICKEL: 53(PETRO-CAN 81)

18.3 H_2S (WT %): NIL(PETRO-CAN 81)

18.4 YIELD ON CRUDE:

	WT %	VOL %
GAS	0.8	0.9
BUT. GASOLINE TO 149 °C	9.65	12.45
KEROSINE 149-232 °C	9.75	11.35
GAS OIL 232-343 °C	14.65	15.75
RESIDUE above 343 °C	65.15	59.55

(PETRO-CAN 81)

MAYOGIAK CRUDE OIL

1.0 TYPE: Mayogiak Crude Oil, Beaufort Sea.

2.0 API GRAVITY: 32.4(EETD 89)

3.0 DENSITY (g/mL):

For $F < 12$ % & T at 20 deg C:
DEN = 0.863686 + 0.001809 F
where: DEN is density of oil at T and F (g/mL)
F is percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	WEATHERING (%) 0	4	12
20	0.8625 (ENGELHARDT 84)	0.8727 (ENGELHARDT 84)	0.8848 (ENGELHARDT 84)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0	4	12
-10	752.1 (ENGELHARDT 84)	1023 (ENGELHARDT 84)	DNF (ENGELHARDT 84)
0	67.27 (ENGELHARDT 84)	98.35 (ENGELHARDT 84)	414.3 (ENGELHARDT 84)
15	17.04 (ENGELHARDT 84)	29.88 (ENGELHARDT 84)	56.37 (ENGELHARDT 84)
25	9.702 (ENGELHARDT 84)	18.33 (ENGELHARDT 84)	30.41 (ENGELHARDT 84

NOTE: DNF - DID NOT FLOW

MAYOGIAK CRUDE OIL

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C):

WEATHERING (%)	POUR POINT (°C)
0	-30(ENGELHARDT 84)
4	-26(ENGELHARDT 84)
12	-18(ENGELHARDT 84)

7.0 FLASH POINT (°C):

WEATHERING (%)	FLASH POINT (°C)
0	-12(ENGELHARDT 84)
4	47(ENGELHARDT 84)
12	66(ENGELHARDT 84)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME % CONDENSED	WEATHERING (%)		
	0	4	12
INITIAL	-2 (ENGELHARDT 84)	55 (ENGELHARDT 84)	146 (ENGELHARDT 84)
50	318 (ENGELHARDT 84)	336 (ENGELHARDT 84)	376 (ENGELHARDT 84)
FINAL	555 (ENGELHARDT 84)	554 (ENGELHARDT 84)	558 (ENGELHARDT 84)
FINAL VOLUME CONT'D	94 % (ENGELHARDT 84)	88 % (ENGELHARDT 84)	83 % (ENGELHARDT 84)

MAYOGIAK CRUDE OIL

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 FIRE POINT (°C):

WEATHERING (%)	FIRE POINT (°C)
0	-12(ENGELHARDT 84)
4	64(ENGELHARDT 84)
12	76(ENGELHARDT 84)

McARTHUR RIVER CRUDE OIL

1.0 TYPE: McArthur River Crude Oil, Offshore Cook Inlet, Alaska.

2.0 API GRAVITY: 35.4(COLEMAN 78)

3.0 DENSITY (g/mL): @ 15.6°C: 0.848(COLEMAN 78)

4.0 VISCOSITY (Saybolt Universal seconds):

@ 25°C:	116(COLEMAN 78)
@ 37.8°C:	85(COLEMAN 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -7(COLEMAN 78)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

CUT TEMPERATURE (°C)	VOLUME PERCENT
26	IBP
50	2.4
75	4.9
100	10.8
125	16.9
150	22.0
175	27.2
200	32.1
225	37.2
250	42.4
275	47.4

(COLEMAN 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

McARTHUR RIVER CRUDE OIL

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.08(COLEMAN 78)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 2.1(COLEMAN 78)

18.2 NITROGEN (WT %): 0.137(COLEMAN 78)

18.3 COLOUR: BROWNISH BLACK(COLEMAN 78)

MENEMOTA CRUDE OIL

1.0 TYPE: Menemota Crude Oil, 1982.

2.0 API GRAVITY: 19.7(PETRO-CAN 82)

3.0 DENSITY (g/mL): @ 15 °C: 0.936(PETRO-CAN 82)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

@ 40 °C: 91.7(PETRO-CAN 82)
@ 100 °C: 13.1(PETRO-CAN 82)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): < -30(PETRO-CAN 82)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): <0.15(PETRO-CAN 82)

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMP (°C)
IBP	62
10	180
20	255
29	300

(ASTM D 86)(PETRO-CAN 82)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 5.7 (PETRO-CAN 82)

14.0 WAX CONTENT (WT %): 2.51 (PETRO-CAN 82)

14.1 CONGEALING POINT OF WAX (°C): 58.5(PETRO-CAN 82)

15.0 AQUEOUS SOLUBILITY:

MENEMOTA CRUDE OIL

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.32(PETRO-CAN 82)

18.0 OTHERS:

18.1 ASH (WT %): 0.07(PETRO-CAN 82)

18.2 METALS (PPM):

VANADIUM:	390(PETRO-CAN 82)
NICKEL:	49(PETRO-CAN 82)
SODIUM:	1(PETRO-CAN 82)
IRON:	<1(PETRO-CAN 82)
COPPER:	<1(PETRO-CAN 82)
CHROMIUM:	0(PETRO-CAN 82)

18.3 H_2S (WT %): <1(PETRO-CAN 82)

18.4 ACID NUMBER (mgKOH/g): 1.03(PETRO-CAN 82)

18.5 UOP K CHARACTERIZATION FACTOR: 11.7(PETRO-CAN 82)

18.6 YIELD ON CRUDE:

	WT %	VOL %
STRAIGHT-RUN GASOLINE UP TO 65 °C	1.78	2.64
NAPHTHA 65-150 °C	5.70	7.15
KEROSINE 150-250 °C	10.46	11.88
GAS OIL 250-370 °C	18.28	19.07
RESIDUE above 370 °C	63.79	59.26

(PETRO-CAN 82)

MIDDLE GROUND SHOAL CRUDE OIL

1.0 TYPE: Middle Ground Shoal Crude Oil, Offshore Cook Inlet, Alaska.

2.0 API GRAVITY: 41.5(COLEMAN 78)

3.0 DENSITY (g/mL): @ 15.6°C: 0.818(COLEMAN 78)

4.0 VISCOSITY (Saybolt Universal seconds):

@ 25°C:	47(COLEMAN 78)
@ 37.8°C:	43(COLEMAN 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): <-15(COLEMAN 78)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

CUT TEMPERATURE (°C)	VOLUME PERCENT
26	IBP
50	2.1
75	5.9
100	13.4
125	22.8
150	32.1
175	37.4
200	42.1
225	47.8
250	53.3
275	58.1

(COLEMAN 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

MIDDLE GROUND SHOAL CRUDE OIL

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.07(COLEMAN 78)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 1.5(COLEMAN 78)

18.2 NITROGEN (WT %): 0.047(COLEMAN 78)

18.3 COLOUR: BROWNISH BLACK(COLEMAN 78)

MIXED SOUR BLEND CRUDE OIL

1.0 TYPE: IPPL Mixed Sour Blend.
Blend of light, moderately low sulphur crude
from fields in Alberta and Saskatchewan.
Sample from pipeline blend delivered to
Trafalgar Refinery, December 1974.

2.0 API GRAVITY: 38.6(PETRO-CAN 75)

3.0 DENSITY (g/mL): @ 20 °C: 0.828(PETRO-CAN 75)

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -6(PETRO-CAN 75)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.3(PETRO-CAN 75)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.46(PETRO-CAN 75)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 1.9(PETRO-CAN 75)

18.2 METALS (PPM): VANADIUM: <2(PETRO-CAN 75)
NICKEL: 2(PETRO-CAN 75)

18.3 WATER (WT %): NIL(PETRO-CAN 75)

18.4 YIELD ON CRUDE:

	WT %	VOL %
GAS	1.0	1.55
BUT. GASOLINE TO 149 °C	19.55	22.45
KEROSINE 149-232 °C	16.1	16.85
GAS OIL 232-343 °C	21.65	21.35
RESIDUE above 343 °C	41.7	37.8

(PETRO-CAN 75)

MONTROSE CRUDE OIL

1.0 TYPE: Montrose Crude Oil (UK, North Sea).

2.0 API GRAVITY (15/15°C): 40.7 (NSD 88)
40.1 (AALUND 83c)

3.0 DENSITY (g/mL): 0.8220 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @20°C: 4.96 (AALUND 83c)
@38°C: 3.27 (AALUND 83c)
@40°C: 3.17 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -6 (NSD 88)
-9 (AALUND 83c)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 27.6 (ALLUND 83c)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.15(NSD 88)

14.0 WAX CONTENT :

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.23 (AALUND 83c)

MONTROSE CRUDE OIL

18.0 OTHERS:

18.1 METALS (PPM): NICKEL: 2
VANADIUM: 2(AALUND 83c)

18.2 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1-C_4		2.2
GASOLINE	C_5-93	12.3
NAPHTHA	93-160	15.0
KEROSINE	160-204	8.9
GAS OIL	204-343	25.4
RESIDUE	343+	36.6

(AALUND 83c)

MURBAN CRUDE OIL

1.0 TYPE: Murban Crude Oil.

2.0 API GRAVITY: 39.2(EETD 89)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (WT %) 0	10	20
0	0.838 (MACKAY 82a)		
5	0.832 (MACKAY 82a)		
10	0.830 (MACKAY 82a)		
15	0.828 (MACKAY 82a)		
20	0.824 (MACKAY 82a)	0.842 (MACKAY 82a)	0.855 (MACKAY 82a)
25	0.822 (MACKAY 82a)		

NOTES: DEN = 0.837 - 0.000606 T
WHERE: DEN IS OIL DENSITY OF AT T (g/mL)
T IS OIL TEMPERATURE (°C) (MACKAY 82a)

4.0 VISCOSITY:
4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	40.1(MACKAY 82a)
5	22.1(MACKAY 82a)
10	11.9(MACKAY 82a)
15	6.97(MACKAY 82a)
20	4.37(MACKAY 82a)
25	3.90(MACKAY 82a)

NOTES: VISC = EXP((7960/(T+273)) - 25.6)
WHERE: VISC IS THE VISCOSITY OF FRESH OIL AT T (mPa.s)
EXP IS EXPONENTIAL BASE e
T IS OIL TEMPERATURE (°C) (MACKAY 82a)

MURBAN CRUDE OIL

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	47.9(MACKAY 82a)
5	26.6(MACKAY 82a)
10	14.3(MACKAY 82a)
15	8.42(MACKAY 82a)
20	5.30(MACKAY 82a)
25	4.74(MACKAY 82a)
40	2.70(NSD 88)

5.0 INTERFACIAL TENSIONS:

5.1 OIL-AIR (mN/m or dynes/cm):

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0	10	20
?	16.3(MACKAY 82a)	16.4(MACKAY 82a)	14.3(MACKAY 82a)

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	-3(MACKAY 82a) -12(WHEELER 78) -24(NSD 88)
10	0(MACKAY 82a)
20	15(MACKAY 82a)

MURBAN CRUDE OIL

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILTY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

		WEATHERING (WT %)	
GROUP	0	10	20
SATURATES	81.4	76.3	74.3
AROMATICS	16.6	17.5	19.4
POLARS	1.27	2.05	2.12
ASPHALTENES	0.75	4.14	4.20

(MACKAY 82a)

14.0 WAX CONTENT (WT %):

WEATHERING (WT %)	WAX (WT %)
0	5.68(MACKAY 82a)
10	6.83(MACKAY 82a)
20	7.45(MACKAY 82a)

15.0 AQUEOUS SOLUBILITY (mg/L):

in double-distilled water @ room temp:	28.62(BOBRA 83)
in seawater:	27.87(MCAULIFFE 77)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:
48 hour LC_{50}: 7.4(BOBRA 83)

17.0 SULPHUR (WT %): 0.78(NSD 88)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 0.14(NSD 88)

MURCHISON CRUDE OIL

1.0 TYPE: Murchison Crude Oil (UK and Norway, North Sea). Contributor to Brent system at Sullom Voe, Shetland Islands.

2.0 API GRAVITY (15/15°C): 38.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8510 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 3.60 (AALUND 83c)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 7.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 62.0 (AALUND 83c)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 4.70 (NSD 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.27 (NSD 88)

18.0 OTHERS:

18.1 METALS (PPM): NICKEL: 0.7
VANADIUM: 2.5(AALUND 83c)

18.2 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1-C_4		3.0
NAPHTHA	30-191	31.2
KEROSINE	191-271	13.5
HEAVY DISTILLATE	271-371	21.4
GAS OIL	371-549	21.0
RESIDUE	549+	11.9

(AALUND 83c)

NAPHTHA (MINERAL SPIRITS)

1.0 TYPE: Naphtha, Mineral Spirits.
Synonyms: white spirits, petroleum spirits, light petrol, Stoddard solvent, Varsol and Shell Sol 140. (TIPS 85)

2.0 API GRAVITY: 48.8 to 50.6(ESSO 73)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.8040(EETD 86)
15	0.7930(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	1.4(EETD 86)
15	1.1(EETD 86)
25	0.85 to 1.165(ESSO 73)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	1.78(EETD 86)
15	1.43(EETD 86)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	26.2(EETD 86)
15	24.7(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	43.2(EETD 86)
15	43.1(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	44.4(EETD 86)
15	43.9(EETD 86)

6.0 POUR POINT (°C): -69(EETD 86)

7.0 FLASH POINT (°C): 41 to 57(T.C.C.)(ESSO 73)
41 to 138(T.C.C.)(GULF TS 83)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

BOILING RANGE(°C):		
	MINERAL SPIRITS:	150 to 200(NIOSH 77)
	STODDARD SOLVENT:	160 to 210(NIOSH 77)

NAPHTHA (MINERAL SPIRITS)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 86)
15	0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 86)
15	0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 86)
15	N/M(EETD 86)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (%):

	MINERALS SPIRITS	STODDARD SOLVENT
composed of	C_9-C_{10} hydrocarbons	C_9-C_{11} hydrocarbons
PARAFFINS	30 to 65	30 to 50
NAPHTHENES	15 to 55	30 to 40
AROMATICS	10 to 30	10 to 20(NIOSH 77)

NAPHTHA (MINERAL SPIRITS)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (PPM): 1(ESSO 73)

18.0 OTHERS:

18.1 COLOUR: +30(ESSO 73)

NAPHTHA (PETROLEUM ETHER)

1.0 TYPE: Naphtha, Petroleum Ether.
Synonyms: benzin, benzine, petroleum benzin, canadol, light ligroin, Skellysolve.(TIPS 85)

2.0 API GRAVITY (15/15°C): 89.3(EETD 86)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%)
	0
0	0.6547(EETD 86)
15	0.6404(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%)
	0
0	0.30(EETD 86)
15	0.25(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%)
	0
0	0.45(EETD 86)
15	0.39(EETD 86)

NAPHTHA (PETROLEUM ETHER)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (^{o}C)	WEATHERING (%) 0
0	18.2(EETD 86)
15	17.5(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (^{o}C)	WEATHERING (%) 0
0	44.8(EETD 86)
15	43.8(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (^{o}C)	WEATHERING (%) 0
0	45.5(EETD 86)
15	44.4(EETD 86)

6.0 POUR POINT:

7.0 FLASH POINT (^{o}C): -49(CCD 77)
<-18(NFPA 78)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA: BOILING POINT/DISTILLATION RANGE (^{o}C): 30 to 60(CCD 77)
35 to 60(NFPA 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 86)
15	0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 86)
15	0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 86)
15	N/M(EETD 86)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS: primarily pentane and i-hexane, no aromatics(NIOSH 77)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 AUTOIGNITION TEMPERATURE (°C): 288(CCD 77)(NFPA 78)

18.2 FREEZING POINT (°C): -73(CCD 77)

18.3 VAPOUR DENSITY: 2.5(NIOSH 77)

18.4 FLAMMABILITY LIMITS (VOL %): UPPER: 5.9(NFPA 78)
LOWER: 1.1(NFPA 78)

NAPHTHA (RUBBER SOLVENT)

1.0 TYPE: Naphtha, Rubber Solvent.
Synonyms: benzine, lacquer diluent, light spirits, Iosol and Tolu-Sol.(TIPS 85)

2.0 API GRAVITY: 58.7 to 67.5(ESSO 73)

3.0 DENSITY (g/mL): 0.711 to 0.7440(ESSO 73)
0.74 to 0.771(ISH 77)
0.7038 to 0.7398(GULF TS 83)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0
25	0.40 to 0.50(EETD 86)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT (°C): -23 to -4(T.C.C.)(ESSO 73)
-5, -4(ISH 77)
<20(GULF TS 83)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA: BOILING RANGE (°C):

RUBBER SOLVENT:	45 to 125(NIOSH 77)
LIGHT SPIRITS:	95 to 110(PPH 60; MPT 75; ASTM 62)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

NAPHTHA (RUBBER SOLVENT)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (%):

composed of C_5 to C_8 hydrocarbons

PARAFFINS	70 to 90
NAPHTHALENES	11 to 22
AROMATICS	9 to 22

16.0 TOXICITY:

17.0 SULPHUR (PPM): 1(ESSO 73)

18.0 OTHERS:

18.1 ANILINE POINT(°C): 50 to 54(ESSO 73)

NAPHTHA (VARNISH MAKERS & PAINTERS NAPHTHA)

1.0 TYPE: Varnish Makers and Painters Naphtha. VM&P Naphtha. Synonyms: benzine, naphtha 76, ligroin, high boiling petroleum ether, light naphtha, dry-cleaning naphtha and spotting naphtha. (TIPS 85)

2.0 API GRAVITY:

3.0 DENSITY:

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
20	19 to 23(CHRIS 78)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
?	39 to 51(CHRIS 78)

6.0 POUR POINT:

7.0 FLASH POINT (°C):
-2 to 29(NFPA 78)
-8, -7(ALLIANCE 80)
-13, -7(CHRIS 78)
<20(T.C.C.)(GULF TS 83)
12(T.C.C.)(ESSO 73)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA: BOILING RANGE (°C):
100 to 140(PPH 60; MPT 75; ASTM 62)
95 to 160(NIOSH 77)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

NAPHTHA (VARNISH MAKERS & PAINTERS NAPHTHA)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (%):

composed of C_7 to C_{11} hydrocarbons

PARAFFINS	45 to 60
NAPHTHALENES	30 to 45
AROMATICS	5 to 13 (NIOSH 77)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 AUTOIGNITION TEMPERATURE (°C): 232(NFPA 78)

18.2 VAPOUR DENSITY: 4.3, 4.1(NFPA 78)

18.3 FLAMMABILITY LIMIT (VOL %):

LOWER:	0.9(NFPA 78)(ALLIANCE 80)(CHRIS 78) 1.0(NFPA 78)
UPPER:	6.0(NFPA 78)(ALLIANCE 80) 6.7(NFPA 78)(CHRIS 78)

18.4 BURNING RATE (mm/min.): 4.4(CHRIS 78)

NEKTORALIK K-59 CRUDE OIL

1.0 TYPE: Nektoralik K-59 Crude Oil. Beaufort Sea, Canada.

2.0 API GRAVITY: 26.1(DOME 84)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.9166(EETD 89)
15	0.9060(EETD 89)
15.6	0.8541(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
10	21(DOME 84)
20	12.90(DOME 84)
30	9.80(DOME 84)
40	6.78(DOME 84)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	28.5(EETD 89)
15	29.0(EETD 89)

NEKTORALIK K-59 CRUDE OIL

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	3.4(EETD 89)
15	41.6(EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	14.8(EETD 89)
15	15.1(EETD 89)

6.0 POUR POINT (°C): 2.8(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMP (°C)
5	121
10	160
15	198
20	238
25	254
30	277
35	287
40	298
45	304
50	312
55	321
60	338
65	342
70	343(DOME 84)

NEKTORALIK K-59 CRUDE OIL

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	1.0(EETD 89)
15	0(EETD 89)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	1.0(EETD 89)
15	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	88.0(EETD 89)
15	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILTY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.40(EETD 89)

14.0 WAX CONTENT (WT %): 1.10(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

NEKTORALIK K-59 CRUDE OIL

17.0 SULPHUR (WT %): 0.17(DOME 84)(EETD 89)

18.0 OTHERS:

18.1 TOTAL SALTS (g/m^3): 0.5992(DOME 84)

NEKTORALIK K-59A CRUDE OIL

1.0 TYPE: Nektoralik K-59A Crude Oil. Beaufort Sea, Canada.

2.0 API GRAVITY: 39.9(DOME 84)

3.0 DENSITY (g/mL): 0.8257(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
20	1.396(DOME 84)
30	1.205(DOME 84)
40	1.020(DOME 84)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
20	1.695(DOME 84)
30	1.475(DOME 84)
40	1.260(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -39(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMP (°C)
5	90
10	101
15	111
20	120
25	131
30	140
35	153
40	170
45	186
50	201
55	217
60	231
65	243
70	254
75	267
80	280
85	294
90	313
95	323(DOME 84)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.0067(DOME 84)

18.0 OTHERS:

18.1 TOTAL SALTS (g/m^3): 32.075(DOME 84)

NERLERK M-98A CRUDE OIL

1.0 TYPE: Nerlerk M-98A Crude Oil. Beaufort Sea, Canada.

2.0 API GRAVITY: 22.3(DOME 84)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.9195(EETD 89)
15	0.9095(EETD 89)
15.6	0.9227(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
20	89.6(DOME 84)
30	50.3(DOME 84)
40	30.0(DOME 84)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	29.3(EETD 89)
15	29.0(EETD 89)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	5.2(EETD 89)
15	11.0(EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	17.9(EETD 89)
15	15.6(EETD 89)

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	0.44(EETD 89)
15	0(EETD 89)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0.44(EETD 89)
15	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	79.0(EETD 89)
15	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.40(EETD 89)

14.0 WAX CONTENT (WT %): 0.74(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.14(EETD 89)

18.0 OTHERS:

NERLERK M-98B CRUDE OIL

1.0 TYPE: Nerlerk M-98B Crude Oil. Beaufort Sea, Canada.

2.0 API GRAVITY: 24.3(DOME 84)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.9114(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
20	54.3(DOME 84)
30	30.6(DOME 84)
40	19.4(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

NERLERK M-98C CRUDE OIL

1.0 TYPE: Nerlerk M-98C Crude Oil. Beaufort Sea, Canada.

2.0 API GRAVITY: 26.4(DOME 84)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.8981(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
20	12.7(DOME 84)
30	8.84(DOME 84)
40	6.34(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

NINIAN CRUDE OIL

1.0 TYPE: Ninian Crude Oil (U.K., North Sea).

2.0 API GRAVITY (15/15°C): 35.1 (NSD 88)

3.0 DENSITY (g/mL): @16°C: 0.8393(LYNCH 81)
0.8400(NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @38°C: 6.9 (NSD 88)
@50°C: 7.5(LYNCH 81)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 6(LYNCH 81)
7 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

WEIGHT PERCENT	TEMP (°C)
6.7	5 TO 100
12.7	100 TO 160
12.1	160 TO 250
19.7	250 TO 350
48.8	>350(LYNCH 81)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.5(LYNCH 81)

14.0 WAX CONTENT (WT %): 8 (LYNCH 81)
5.30 (NSD 88)

NINIAN CRUDE OIL

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.41 (NSD 88)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 5.00 (NSD 88)

NINIAN BLEND CRUDE OIL

1.0 TYPE: Ninian Blend Crude Oil (U.K. North Sea). Ninian system to Sullom Voe, Shetland Islands.

2.0 API GRAVITY (15/15°C): 35.6 (AALUND 83c)

3.0 DENSITY:

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40°C: 5.61 (AALUND 83c)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 2 (AALUND 83c)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.43 (AALUND 83c)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1 - C_4		2.6
LIGHT GASOLINE	C_5-149	19.9
NAPHTHA	149-204	9.3
KEROSINE	204-260	11.1
DIESEL OIL	260-343	14.0
GAS OIL	343-435	13.1
HEAVY GAS OIL	435-538	14.0
RESIDUE	538+	16.0

(AALUND 83c)

NORMAN WELLS CRUDE OIL

1.0 TYPE: Norman Wells Crude Oil. Northwest Territories, Canada.

2.0 API GRAVITY (15/15°C): 38.4(EETD 84)

3.0 DENSITY (g/mL):

For Fw < 20.4 % & T between 0 and 25 °C:
DEN = 0.846161 + 0.001732 Fw - 0.000783 T
where: DEN is density of oil at T and Fw (g/mL)
Fw is weight percent of oil weathered
T is oil temperature (°C)

TEMP (°C)		WEATHERING (WT %)	
	0	12	20.4
0	0.845(MACKAY 82a) 0.840(MACKAY 75) 0.8581(EETD 85)	0.864(MACKAY 82a)	0.881(MACKAY 82a)
5	0.841(MACKAY 82a)		
10	0.839(MACKAY 82a)		
15	0.832(EETD 84) 0.834(MACKAY 82a) 0.832(MACKAY 75)	0.855(MACKAY 75)	0.873(MACKAY 75)
20	0.832(MACKAY 82a)		
25	0.829(MACKAY 82a)	0.844(MACKAY 75)	0.863(MACKAY 75)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

VISC = exp(2.26 - 2461.7 T/(273(T+273)))
where: VISC is dynamic viscosity of oil at T (mPa.s)
exp is exponential base e
T is oil temperature (°C)

TEMP (°C)	WEATHERING (WT %) 0	20.4	42.3
-25	22(MACKAY 75)	99(MACKAY 75)	
-15	18(MACKAY 75)	69(MACKAY 75)	
0	8.76(MACKAY 82a) 14.2(TWARDUS 80) 11(MACKAY 75)	40(MACKAY 75)	300(MACKAY 75)
5	7.11(MACKAY 82a)		
10	5.81(MACKAY 82a) 8.68(TWARDUS 80) 9(MACKAY 75)	28(MACKAY 75)	180(MACKAY 75)
15	5.05(MACKAY 82a) 7.9(MACKAY 75)	25(MACKAY 75)	150(MACKAY 75)
20	4.39(MACKAY 82a) 5.9(TWARDUS 80)		
25	3.93(MACKAY 82a) 6.1(MACKAY 75)	15(MACKAY 75)	80(MACKAY 75)

NORMAN WELLS CRUDE OIL

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	0	WEATHERING (WT %) 20.4	42.3
0	10.37(MACKAY 82a) 13.1(MACKAY 75)	46(MACKAY 75)	34(MACKAY 75)
5	8.45(MACKAY 82a)		
[illegible]	6.93(MACKAY 82a)		
15	6.06(MACKAY 82a) 9.5(MACKAY 75)	29(MACKAY 75)	172(MACKAY 75)
20	5.28(MACKAY 82a)		
25	4.74(MACKAY 82a)	18(MACKAY 75)	93(MACKAY 75)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (WT %) 20.4	42.3
0	24.9(EETD 84)		
5	23.7(MACKAY 75)	28.2(MACKAY 75)	29.8(MACKAY 75)
15	23.6(EETD 84)		
25	22.7(MACKAY 75)	27(MACKAY 75)	28.5(MACKAY 75)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	0	WEATHERING (WT %)
0	16.5(EETD 84)	
15	16.4(EETD 84)	

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (WT %) 0
0	20.5(EETD 85)
15	20.1(EETD 85)

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	<-50(MACKAY 82a) -85(TWARDUS 80) -50(MACKAY 75)
10	<-50(MACKAY 82a)
12	-34(MACKAY 75)
20	<-50(MACKAY 82a)
20.4	-26(MACKAY 75)
36.7	-12(MACKAY 75)

NOTES: Pour Point = $-51 + 1.50 E - 0.012 E^2$
WHERE: E = WT % EVAPORATED (MACKAY 75)

7.0 FLASH POINT (°C): 3(C.C.)(EETD 84)

8.0 VAPOUR PRESSURE (kPa): 36.2(EETD 84)

NORMAN WELLS CRUDE OIL

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)
0	60
10	118
20	145
30	174
40	223
50	280

DATA OBTAINED FROM A CURVE(MACKAY 75)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 84)
15	0(EETD 84)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 84)
15	0(EETD 84)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 84)
15	N/M(EETD 84)

NORMAN WELLS CRUDE OIL

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 5315.8\ \Theta\ \exp(6.3 - 3911.9/T_k)/T_k)}{(5315.8/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(EETD 84)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	36
CRX-8	43
ENER 700	51
DASIC	26(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 5(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

GROUP	0	WEATHERING (WT %) 10	20
SATURATES	85.1(MACKAY 82a) 86.3(EETD 86)	82.2(MACKAY 82a)	80.0(MACKAY 82a)
AROMATICS	11.4(MACKAY 82a) 11.1(EETD 86)	11.5(MACKAY 82a)	13.1(MACKAY 82a)
POLARS	2.32(MACKAY 82a) 1.6(EETD 86)	3.45(MACKAY 82a)	4.13(MACKAY 82a)
ASPHALTENES	1.13(MACKAY 82a) 1.0(EETD 86) 1.15(EETD 89)	2.88(MACKAY 82a)	3.20(MACKAY 82a)

14.0 WAX CONTENT (WT %):

WEATHERING (WT %)	WAX (WT %)
0	1.76(MACKAY 82a) 1.25(EETD 89)
10	2.29(MACKAY 82a)
20	1.90(MACKAY 82a)

15.0 AQUEOUS SOLUBILITY (mg/L):

WEATHERING (WT %)	SOLUBILITY (mg/L)
0	32.3(MACKAY 75) 32.3(BOBRA 83) 33.5 @ 22°C in distilled water(MAIJANEN 84) 33.0 @ 20°C in distilled water(MAIJANEN 84) 28.0 @ 20°C in salt water(MAIJANEN 84) 30.0 @ 5°C in distilled water(MAIJANEN 84) 25.5 @ 5°C in salt water(MAIJANEN 84) 60.1(MURRAY 84) 25.5 @ 22°C in fresh water(SUNTIO 86) 8.57(MACLEAN 88)
6	23.18(MACKAY 75) 27.0(BOBRA 83)
12	14.59(MACKAY 75) 14.6(BOBRA 83)
20.4	7.33(MACKAY 75) 7.3(BOBRA 83)
29	2.27(MACKAY 75)
36	0.68(BOBRA 83)
43.2	0.14(BOBRA 83)

NOTE: FOR (BOBRA 83) SOLUBILITY WAS MEASURED IN DOUBLE DISTILLED WATER AT ROOM TEMPERATURE.

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

WEATHERING (WT %)	48 hour LC_{50} (mg/L)	48 hour EC_{50} (mg/L)
0	9.0(BOBRA 83) 18.5(BOBRA 88)	3.4(BOBRA 83)
6	10.8(BOBRA 83)	
12	6.0(BOBRA 83)	
20.4	4.4(BOBRA 83)	
36.7	0.49(BOBRA 83)	
43.2	0.12(BOBRA 83)	

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

48 hour EC_{50}:	3.61(MACLEAN 88) 8.59(BOBRA 88)
48 hour LC_{50}:	4.34(MACLEAN 88) 10.3(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO LARVAL RAINBOW TROUT:

48 hour LC_{50} (closed container):	10.4(LOCKHART 87)
48 hour LC_{50} (open container):	11.6(LOCKHART 87)

17.0 SULPHUR (WT %): 0.37(EETD 86)

18.0 OTHERS:

18.1 FIRE POINT (^{o}C): <13.5 (TWARDUS 80)

NORTH CORMORANT CRUDE OIL

1.0 TYPE: North Cormorant Crude Oil (UK, North Sea).
Contributor to Brent system at Sullom Voe, Shetland Islands.

2.0 API GRAVITY (15/15°C): 34.9 (AALUND 83b)

3.0 DENSITY (g/mL): @15°C: 0.850 (AALUND 83b)

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 12.0 (AALUND 83b)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.71 (AALUND 83b)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1 - C_4		2.6
GASOLINE	C_5-85	7.0
NAPHTHA	85-165	14.5
KEROSINE	165-235	11.7
GAS OIL	235-300	12.5
GAS OIL	300-350	9.4
RESIDUE	350+	42.7

(AALUND 83b)

NORTH EAST TEXAS CRUDE OIL

1.0 TYPE: North East Texas Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 27.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8900 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 27.0 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.50 (NSD 88)

18.0 OTHERS:

NORTH SLOPE CRUDE OIL

1.0 TYPE: North Slope Crude Oil. Alaska.

2.0 API GRAVITY: 26.8(API 81)

3.0 DENSITY (g/mL): @ 15.5°C: 0.893(API 81)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @38°C: 16.0(NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -21(NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)
5	98
10	131
15	161
20	193
25	216
30	241
35	262
40	282
45	301
50	323
55	342
60	361
65	380
70	400
75	419
80	439
85	461
90	484
95	511
FBP	539

NOTE: DATA FROM SIMULATED DISTILLATION ASTM METHOD D 2887 (API 81)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.04(API 81)

18.0 OTHERS:

18.1 NITROGEN (WT %): 0.20(API 81)

18.2 METALS (PPM):	NICKEL:	21(API 81)
	VANADIUM:	9.4 TO 9.7(API 81)

OSEBERG CRUDE OIL

1.0 TYPE: Oseberg Crude Oil, Oseberg, Norway. North Sea.

2.0 API GRAVITY: 33.7(CORBETT 89)

3.0 DENSITY:

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @20°C: 8.52(CORBETT 89)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -6(CORBETT 89)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.31(CORBETT 89)

18.0 OTHERS:

18.1 CON. CARBON RESIDUE (WT %): 2.6(CORBETT 89)

18.2 WATER CONTENT (VOLUME %): 0.10(CORBETT 89)

18.3 SALT AS NaCl (PPM): 5.0(CORBETT 89)

18.4 TOTAL ACID NO.(mg KOH/g): 0.22(CORBETT 89)

18.5 METALS (PPM):		
	NICKEL	4(CORBETT 89)
	VANADIUM	<2(CORBETT 89)
	SODIUM	<2(CORBETT 89)

18.6 YIELD ON CRUDE:

	RANGE, °C	WEIGHT %	VOLUME %
GASOLINE	C_5-90	5.46	6.83
LIGHT NAPHTHA	90-160	11.62	13.05
HEAVY NAPHTHA	160-180	3.47	3.77
GAS OIL	180-240	10.66	11.17
GAS OIL	240-320	17.61	17.62
GAS OIL	320-375	10.34	9.96
HEAVY GAS OIL	375-420	6.36	6.01
HEAVY GAS OIL	420-525	16.9	15.56
RESIDUUM	525+	16.01	13.69

(CORBETT 89)

PANUKE CRUDE OIL

1.0 TYPE: Panuke F-99 Crude Oil, Canadian Eastcoast Offshore.
Data for separator oil sampled 87/08/07, Petro-Canada Incorporated.

2.0 API GRAVITY (15.5/15.5°C): 56.9(PETRO-CAN 87)

3.0 DENSITY (g/mL):

TEMP (°C)		WEATHERING (%)	
	0	32.1	47.4
1	0.7865(EETD 89)	0.8130(EETD 89)	0.8277(EETD 89)
15	0.7757(EETD 89) 0.7507(PETRO-CAN 87)	0.8021(EETD 89)	0.8168(EETD 89)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)		WEATHERING (%)	
	0	32.1	47.4
1	1.87(EETD 89)	3.34(EETD 89)	4.77(EETD 89)
15	1.47(EETD 89)	2.43(EETD 89)	3.45(EETD 89)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-36(EETD 89)
32.1	-21(EETD 89)
47.4	-18(EETD 89)

7.0 FLASH POINT (°C):

WEATHERING (VOLUME %)	FLASH POINT (°C)
0	-30(EETD 89)
32.1	32(EETD 89)
47.4	64(EETD 89)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	32.1	47.4
0	0(EETD 89)	0(EETD 89)	0(EETD 89)
15	0(EETD 89)	0(EETD 89)	0(EETD 89)

10.2 EMULSION STABILITY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	32.1	47.4
0	0(EETD 89)	0(EETD 89)	0(EETD 89)
15	0(EETD 89)	0(EETD 89)	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0	32.1	47.4
0	N/M(EETD 89)	N/M(EETD 89)	N/M(EETD 89)
15	N/M(EETD 89)	N/M(EETD 89)	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

WEATHERING (VOLUME %)	DISPERSANT	% EFFECTIVENESS
0	C9527	96
	CRX-8	78
	ENER 700	96
	DASIC	40
47.4	C9527	99
53.2	C9527	99(FINGAS 90)

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

WEATHERING (VOLUME %)	% DISPERSED
0	13
32.1	8
47.4	6
53.2	5(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

WEATHERING (VOLUME %)	ASPHALTENES (WEIGHT %)
0	0.29(EETD 89)
32.1	0.34(EETD 89)
47.4	0.52(EETD 89)
53.2	0.40(EETD 89)

14.0 WAX CONTENT (WT %):

WEATHERING (VOLUME %)	WAX (WEIGHT %)
0	0.83(EETD 89)
32.1	0.90(EETD 89)
47.4	0.93(EETD 89)
53.2	1.06(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR (WEIGHT %)
0	0.04(EETD 89)
32.1	0.02(EETD 89)
47.4	0.04(EETD 89)
53.2	0.02(EETD 89)

18.0 OTHERS:

18.1 RELATIVE MOLECULAR MASS: 122.94(PETRO-CAN 87)

18.2 COMPOSITIONAL ANALYSIS:

COMPONENT	MOLE FRACTION	MASS FRACTION	VOLUME FRACTION
N_2	0.0001	0.0000	0.0000
CO_2	0.0013	0.0005	0.0004
H_2S	0.0000	0.0000	0.0000
C_1	0.0131	0.0017	0.0043
C_2	0.0024	0.0006	0.0012
C_3	0.0153	0.0055	0.0081
iC_4	0.0255	0.0121	0.0161
C_4	0.0420	0.0198	0.0255
iC_5	0.0518	0.0304	0.0365
C_5	0.0552	0.0324	0.0385
C_6	0.0931	0.0655	
C_7	0.0918	0.0751	
C_8	0.0959	0.0893	
C_9	0.0559	0.0585	
C_{10}	0.0615	0.0714	
C_{11}	0.0432	0.0551	
C_{12}	0.0358	0.0498	
C_{13}	0.0298	0.0449	
C_{14}	0.0267	0.0432	
C_{15}	0.0240	0.0416	
C_{16}	0.0190	0.0351	
C_{17}	0.0140	0.0274	
C_{18}	0.0126	0.0262	
C_{19}	0.0105	0.0230	
C_{20}	0.0075	0.0173	
C_{21}	0.0054	0.0131	
C_{22}	0.0046	0.0117	
C_{23}	0.0029	0.0076	
C_{24}	0.0022	0.0061	
C_{25}	0.0018	0.0052	
C_{26}	0.0012	0.0035	
C_{27}	0.0008	0.0025	
C_{28}	0.0005	0.0018	
C_{29}	0.0005	0.0016	
C_{30+}	0.0006	0.0030	

18.2 COMPOSITIONAL ANALYSIS continued:

COMPONENT	MOLE FRACTION	MASS FRACTION	VOLUME FRACTION
AROMATICS:			
C_6H_{10}	0.0003	0.0002	
C_7H_8	0.0020	0.0015	
C_8H_{10}	0.0157	0.0136	
C_8H_{10}	0.0087	0.0076	
C_9H_{12}	0.0070	0.0069	
NAPHTHENES:			
C_5H_{10}	0.0042	0.0024	
C_6H_{12}	0.0186	0.0128	
C_6H_{12}	0.0311	0.0213	
C_7H_{14}	0.0639	0.0512	

(PETRO-CAN 87)

18.3 FIRE POINT (°C):

WEATHERING (VOLUME%)	FIRE POINT (°C)
0	-30(EETD 89)
32.1	38(EETD 89)
47.4	69(EETD 89)

PARENTIS CRUDE OIL

1.0 TYPE: Parentis Crude Oil (North Sea).

2.0 API GRAVITY (15/15°C): 32.5 (NSD 88)

3.0 DENSITY (g/mL): 0.8630 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 20°C: 9.90 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.39 (NSD 88)

18.0 OTHERS:

PEMBINA CRUDE OIL

1.0 TYPE: Pembina Crude Oil (Canada).

2.0 API GRAVITY (15/15°C): 32.7 (NSD 88)

3.0 DENSITY (g/mL): 0.8620 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 5.20 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.83 (NSD 88)

18.0 OTHERS:

PIPER CRUDE OIL

1.0 TYPE: Piper Crude Oil (U.K., North Sea)

2.0 API GRAVITY (15/15°C): 35.2(HMSO 76)
35.0(NSD 88)

3.0 DENSITY (g/mL): @15°C: 0.849(HMSO 76)
0.8500 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @50°C: 3.55(HMSO 76)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -9(HMSO 76)(NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

WEIGHT PERCENT	TEMPERATURE (°C)
8.4	5-100(HMSO 76)
17.6	100-160(HMSO 76)
11.9	160-250(HMSO 76)
17.9	250-350(HMSO 76)
44.2	>350(HMSO 76)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 4(HMSO 76)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.92(HMSO 76)
1.04 (NSD 88)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 4.14 (NSD 88)

PRIMER ASPHALT

1.0 TYPE: Shell Special Primer Asphalt.

2.0 API GRAVITY (15/15°C): 18.6(EETD 85)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (%) 0
0	0.9526(EETD 85)
15	0.9421(EETD 85)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	12,700(EETD 85)
15	3,280(EETD 85)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	28.8(EETD 85)
15	28.3(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	26.8(EETD 85)
15	24.7(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
0	28.9(EETD 85)
15	27.8(EETD 85)

6.0 POUR POINT (°C): -17(EETD 85)

7.0 FLASH POINT (°C): 16(C.C.)(EETD 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 85)
15	1.0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 85)
15	1.0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (%) 0
0	N/M(EETD 85)
15	55.1(EETD 85)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED): OIL TO DISPERSANT RATIO : 20 TO 1.

TEMP (°C)	WEATHERING (%) 0
0	7(EETD 85)
15	37(EETD 85)

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

TEMP (°C)	WEATHERING (%) 0
0	0(EETD 85)
15	0(EETD 85)

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

PRUDHOE BAY CRUDE OIL

1.0 TYPE: Prudhoe Bay Crude Oil, North Slope, Alaska.

2.0 API GRAVITY: 27.0(USCG 72)(COLEMAN 78)

3.0 DENSITY (g/mL): For $Fw < 24.1$ % and T between 0 and 25 °C:
$DEN = 0.913841 + 0.001582\ Fw - 0.000955\ T$
where: DEN is density of oil at T and Fw (g/mL)
Fw is weight percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	WEATHERING (WT %)				
	0	7.3	9.1	9.8	11.2
0	0.915 (MACKAY 82a)				
	0.909 (MACKAY 82b)				
	0.9037 (EETD 89)		0.9203 (EETD 89)		
5	0.911 (MACKAY 82a)		0.925 (MACKAY 75)		
10	0.910 (MACKAY 82a)				
15	0.905 (MACKAY 82a)		0.9086 (EETD 89)	0.916 (MACKAY 75)	0.937 (MACKAY 75)
	0.899 (MACKAY 75)				
	0.8936 (EETD 89)				
15.6	0.893 (COLEMAN 78)				
20	0.902 (MACKAY 82a)				0.910 (MACKAY 80a)
	0.901 (MACKAY 82a)				
	0.884 (MACKAY 80a)				
	0.881 (USCG 71)	0.902 (MACKAY 82a)			
25	0.900 (MACKAY 82a)			0.905 (MACKAY 75)	
	0.888 (MACKAY 75)				

3.0 DENSITY (g/mL) continued:

TEMP (°C)	WEATHERING (WT %) 16.2	 24.1
0	0.9342 (EETD 89)	
5		0.950 (MACKAY 75)
15	0.9225 (EETD 89)	0.937 (MACKAY 75)
25		0.928 (MACKAY 75)

PRUDHOE BAY CRUDE OIL

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)			WEATHERING (WT %)			
	0	7.3	9.1	9.8	11.2	24.1
-20	180 (MACKAY 75)			540 (MACKAY 75)		3700 (MACKAY 75)
-15	135 (MACKAY 75)			420 (MACKAY 75)		4000 (MACKAY 75)
-8	1000 (MARTIN 77)					
-2	170 (MARTIN 77)					
0	68 (MACKAY 75)			205 (MACKAY 75)		1700 (MACKAY 75)
	500 (MACKAY 82b)					
	50 (MACKAY 80a)	108 (MACKAY 80a)			204 (MACKAY 80a)	
	19 (MARTIN 77)					
	577 (MACKAY 82a)					
5	196 (MACKAY 82a)					
	140 (USCG 71)					
10	103 (MACKAY 82a)					
	80 (USCG 71)					
	96 (MACKAY 82b)					
15	33 (MACKAY 75)		66 (EETD 89)	102 (MACKAY 75)		820 (MACKAY 75)
	26 (MACKAY 80a)	62 (MACKAY 80a)			105 (MACKAY 80a)	
	68.4 (MACKAY 75)					
	50 (USCG 71)					
	23 (EETD 89)					
20	45.7 (MACKAY 82a)					
	34.9 (MACKAY 82b)					
25	20 (MACKAY 75)			55 (MACKAY 75)		400 (MACKAY 75)
	17 (MACKAY 80a)	37 (MACKAY 80a)			61 (MACKAY 80a)	
	35.3 (MACKAY 82a)					

4.2 KINEMATIC VISCOSITY (mm²/sec or cSt):

TEMP (°C)	WEATHERING (WT %) 0	9.8	24.1
0	630 (MACKAY 82a)		
5	216 (MACKAY 82a)		
10	113 (MACKAY 82a)		
15	37 (MACKAY 75) 75.5 (MACKAY 82a)	111 (MACKAY 75)	878 (MACKAY 75)
20	50.7 (MACKAY 82a)		
25	23 (MACKAY 75) 39.2 (MACKAY 82a)	61 (MACKAY 75)	431 (MACKAY 75)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (WT %) 0	9.1	16.2
0	30.4(EETD 85)	29.6(EETD 89)	31.1(EETD 89)
15	28.3(EETD 85) 28.1(EETD 89)	29.1(EETD 89)	29.7(EETD 89)
20	30.1(MACKAY 82b)		

5.0 INTERFACIAL TENSIONS continued:

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (WT %)	
	0	9.1	16.2
0	15.0(EETD 85) 23.8(EETD 89)	27.6(EETD 89)	24.2(EETD 89)
15	9.7(EETD 85) 27.4(EETD 89)	26.6(EETD 89)	24.9(EETD 89)
20	27.0(MACKAY 82b)		

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (WT %)	
	0	9.1	16.2
0	17.6(EETD 85) 26.1(EETD 89)	28.7(EETD 89)	25.7(EETD 89)
15	16.9(EETD 85) 29.4(EETD 89)	27.7(EETD 89)	25.1(EETD 89)

PRUDHOE BAY CRUDE OIL

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	0(MACKAY 82a) -27(MACKAY 80) -9.5(MARTIN 77) -42(MACKAY 75) -9.1(USCG 72) -2(MACKAY 82b) -9.4(COLEMAN 78) -8(EETD 89)
7.3	-16(MACKAY 80)
9.8	-27(MACKAY 75)
11.2	-3(MACKAY 80)
18.2	-18(MACKAY 75)
24.1	-11(MACKAY 75)

7.0 FLASH POINT (°C):

WEATHERING (WT %)	FLASH POINT (°C)
0	30(O.C.)(MACKAY 80)
7.3	71(O.C.)(MACKAY 80)
11.2	84(O.C.)(MACKAY 80)

NOTE: FLASH POINT = 70.0 (1 + 3.7 F)
WHERE: F = VOL FRACTION EVAPORATED (MACKAY 82b)

8.0 VAPOUR PRESSURE (kPa): 23.1(EETD 89)

PRUDHOE BAY CRUDE OIL

9.0 DISTILLATION DATA (^{o}C):

VOLUME PERCENT	VAPOUR TEMPERATURE	LIQUID TEMPERATURE
IBP	50(MACKAY 75)	166(MACKAY 82b)
	42(EETD 89)	151(EETD 89)
	67(MACKAY 80)	
	27(COLEMAN 78)	
2.1	75(COLEMAN 78)	
4.7	100(COLEMAN 78)	
5.0	206(MACKAY 82b)	
	98(EETD 89)	200(EETD 89)
8.2	125(COLEMAN 78)	
10	168(MACKAY 75)	246(MACKAY 82b)
	127(EETD 89)	233(EETD 89)
11.8	150(COLEMAN 78)	
15.0	286(MACKAY 82b)	
	147(EETD 89)	267(EETD 89)
15.5	175(COLEMAN 78)	
19.0	200(COLEMAN 78)	
20	235(MACKAY 75)	327(MACKAY 82b)
	172(EETD 89)	298(EETD 89)
23.3	225(COLEMAN 78)	
28.1	250(COLEMAN 78)	
30	290(MACKAY 75)	
	216(EETD 89)	351(EETD 89)
33.1	275(COLEMAN 78)	
40	328(MACKAY 75)	
	238(EETD 89)	399(EETD 89)
45	247(EETD 89)	413(EETD 89)
50	258(EETD 89)	421(EETD 89)
55	265(EETD 89)	426(EETD 89)
60	272(EETD 89)	433(EETD 89)
70	282(EETD 89).	445(EETD 89)

DATA FROM (MACKAY 75) AND (MACKAY 82b) OBTAINED FROM CURVE

10.0 EMULSION FORMATION TENDENCY & STABILITY: FORMS FAIRLY STABLE EMULSION(MACKAY 82b)

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (WT %)	
	0	9.1	16.2
0	1.0(EETD 89)	1.0(EETD 89)	1.0(EETD 89)
15	1.0(EETD 89)	1.0(EETD 89)	1.0(EETD 89)

10.2 EMULSION FORMATION STABILITY:

TEMP (°C)		WEATHERING (WT %)	
	0	9.1	16.2
0	1.0(EETD 89)	1.0(EETD 89)	1.0(EETD 89)
15	1.0(EETD 89)	0(EETD 89)	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)		WEATHERING (WT %)	
	0	9.1	16.2
0	89.0(EETD 89)	74.0(EETD 89)	60.0(EETD 89)
15	85.0(EETD 89)	N/M(EETD 89)	N/M(EETD 89)

PRUDHOE BAY CRUDE OIL

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 8{,}281.2\ \Theta\ \exp(6.3 - 4{,}521.7/T_k)/T_k)}{(8{,}281.2/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporative exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(MACKAY 82b)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

WEATHERING (VOLUME %)	DISPERSANT	% EFFECTIVENESS
0	C9527	13(FINGAS 90)
	CRX-8	13(FINGAS 90)
	ENER 700	35(FINGAS 90)
	DASIC	11(FINGAS 90)
0(1989)	C9527	7(FINGAS 90)
	CRX-8	7(FINGAS 90)
	ENER 700	10(FINGAS 90)
	DASIC	14(FINGAS 90)
7.6(1989)	C9527	6(FINGAS 90)
	CRX-8	6(FINGAS 90)
	ENER 700	16(FINGAS 90)
	DASIC	16(FINGAS 90)
14.5(1989)	C9527	4(FINGAS 90)
	CRX-8	4(FINGAS 90)
	ENER 700	8(FINGAS 90)
	DASIC	10(FINGAS 90)

NOTE: (1989) REFERS TO SAMPLE RECEIVED FROM ESSO RESOURCES, MARCH 1989.

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

TEMP (°C)	WEATHERING (VOLUME %)	% DISPERSED
15	9.1	3(FINGAS 90a)
	16.2	3(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	61.2(CLARK 77)
	86.9(MACKAY 82a)
	78.3(EETD 86)
AROMATICS	35.6(CLARK 77)
	9.94(MACKAY 82a)
	17.6(EETD 86)
POLARS	2.9(CLARK 77)
	1.6(MACKAY 82a)
	2.5(EETD 86)
ASPHALTENES	1.2(CLARK 77)
	1.53(MACKAY 82a)
	2.4(MACKAY 82b)
	1.6(EETD 86)
	2.04(EETD 89)
	2.64(EETD 89) @ 9.1 VOL.% WEATHERED
	5.07(EETD 89) @ 14.6 VOL.% WEATHERED

14.0 WAX CONTENT (WT %):

WEATHERING (WT %)	WAX CONTENT (WT %)
0	3.86(MACKAY 82a) 4.5(MACKAY 82b) 0.65(EETD 89)
9.1	1.34(EETD 89)
14.6	1.30(EETD 89)
16.2	0.93(EETD 89)

WAX = 0.045 / (1 - F)
WHERE: WAX = WAX CONTENT (MASS FRACTION)
F = VOL FRACTION EVAPORATED(MACKAY 82b)

15.0 AQUEOUS SOLUBILITY (mg/L):

WEATHERING (WT %)	AQUEOUS SOLUBILITY (mg/L)
0	41.7(MACKAY 80) 29.25(MACKAY 75) 29.3(BOBRA 83) 29.2 @ 20°C(MACKAY 82b) 25.5 @ 22°C in fresh water(SUNTIO 86) 20.5 @ 22°C in salt water(SUNTIO 86) 23.90(RICE 76)
7.3	15.0(MACKAY 80)
9.8	4.89(MACKAY 75) 4.91(BOBRA 83)
11.2	7.6(MACKAY 80)
18.2	0.153(BOBRA 83)
24.4	0.102(BOBRA 83)

NOTES: SOLUBILITY = 29.2 EXP(-12.0 Fv)
WHERE: Fv = VOL FRACTION EVAPORATED (MACKAY 82b)
exp= EXPONENTIAL BASE e

NOTE: (BOBRA 83) SOLUBILITY MEASURED IN DOUBLE DISTILLED WATER AT ROOM TEMPERATURE.

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLULBE FRACTION TO DAPHNIA MAGNA:

WEATHERING (WT %)	48 hour LC_{50} (mg/L)
0	9.4(BOBRA 83)
9.8	3.9(BOBRA 83)
18.2	0.15(BOBRA 83)
24.4	0.10(BOBRA 83)

16.0 TOXICITY (mg/L) continued:

96 HOUR LC_{50} VALUES (freshwater) OF WATER SOLUBLE FRACTION:

ARCTIC CHAR:	2.17(MOLES 79)
ARCTIC GRAYLING:	2.04(MOLES 79)
CHINOOK SALMON:	1.47(MOLES 79)
COHO SALMON:	1.45(MOLES 79)
DOLLY VARDEN:	1.25(MOLES 79)
SLIMY SCULPIN:	3.00(MOLES 79)
SOCKEYE SALMON:	1.79(MOLES 79)
3-SPINE STICKLEBACK:	6.89(MOLES 79)

17.0 SULPHUR (WT %):

WEATHERING (WT %)	SULPHUR CONTENT (WT %)
0	0.82(USCG 72) 0.82(COLEMAN 78) 1.15(EETD 89)
9.1	1.19(EETD 89)
16.2	1.30(EETD 89)

18.0 OTHERS:

18.1 COLOUR: BROWNISH BLACK(USCG 72)

18.2 FIRE POINT (°C):

WEATHERING (WT %)	FIRE POINT (°C)
0	35(MACKAY 80)
7.3	86(MACKAY 80)
11.2	91(MACKAY 80)

18.3 INITIAL BOILING POINT (°C):

WEATHERING (WT %)	IBP (°C)
0	67(MACKAY 80)
7.3	102(MACKAY 80)
11.2	192(MACKAY 80)

18.5 CARBON RESIDUE (WT %): 4.7(USCG 72)

18.6 NITROGEN (WT %): 0.230(COLEMAN 78)

RAGUSA CRUDE OIL

1.0 TYPE: Ragusa Crude Oil (North Sea).

2.0 API GRAVITY (15/15°C): 19.8 (NSD 88)

3.0 DENSITY (g/mL): 0.9350 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 277.0 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.30 (NSD 88)

18.0 OTHERS:

RAINBOW L & M CRUDE OIL

1.0 TYPE: Rainbow Light & Medium Crude Oil, Alberta.

2.0 API GRAVITY: 40.7(AALUND 83a)

3.0 DENSITY (g/mL): @ 21 °C: 0.8210(AALUND 83a)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40 °C: 3.77(AALUND 83a)
@ 38 °C: 3.8(NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 2.5(AALUND 83a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 33.9(AALUND 83a)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 20.40(AALUND 83a)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (PPM): 5,000(AALUND 83a)

18.0 OTHERS:

18.1 CON. CARBON (WT %): 1.65(AALUND 83a)

18.2 METALS (PPM):	NICKEL:	0.85(AALUND 83a)
	VANADIUM:	0.50(AALUND 83a)

18.3 H_2S (PPM): 10.2(AALUND 83a)

RAINBOW L & M CRUDE OIL

18.4 YIELD ON CRUDE:

	RANGE, °C	VOL %
NAPHTHA	C_5-190	38.70
KEROSINE	190-277	13.00
DISTILLATE	277-343	11.50
GAS OIL	343-565	31.65
RESIDUE	565+	5.15

(AALUND 83a)

RANGELAND-SOUTH L & M CRUDE OIL

1.0 TYPE: Rangeland-South Light & Medium Crude Oil.

2.0 API GRAVITY: 39.5(AALUND 83a)

3.0 DENSITY (g/mL): @ 21 °C: 0.8267(AALUND 83a)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40 °C: 2.67(AALUND 83a)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -40(AALUND 83a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 39.3(AALUND 83a)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 12.44(AALUND 83a)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (PPM): 7,520(AALUND 83a)

18.0 OTHERS:

18.1 CON. CARBON (WT %): 0.69(AALUND 83a)

18.2 METALS (PPM):	NICKEL:	1.20(AALUND 83a)
	VANADIUM:	1.40(AALUND 83a)

18.3 H_2S (PPM): 20.1(AALUND 83a)

RANGELAND-SOUTH L & M CRUDE OIL

18.4 YIELD ON CRUDE:

	RANGE, °C	VOL %
NAPHTHA	C_5-190	38.75
KEROSINE	190-277	15.50
DISTILLATE	277-343	8.55
GAS OIL	343-565	33.20
RESIDUE	565+	4.0

(AALUND 83a)

REDWATER CRUDE OIL

1.0 TYPE: Redwater Crude Oil (Canada).

2.0 API GRAVITY (15/15°C): 34.7 (NSD 88)

3.0 DENSITY (g/mL): 0.8510 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 6.20 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.54 (NSD 88)

18.0 OTHERS:

SABLE ISLAND CONDENSATE

1.0 TYPE: Sable Island Liquid Condensate.

2.0 API GRAVITY: 39.9(ROSS 82a)

3.0 DENSITY (g/mL):

For $F < 82$ % & T between 0 and 25 °C:
$DEN = 0.865048 + 0.000383 F - 0.000298 T$
where: DEN is density of oil at T and F (g/mL)
F is percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	WEATHERING (%) 0	41	71	82
0	0.878 (MACKAY 82a)			
5	0.834 (ROSS 82a) 0.876 (MACKAY 82a)	0.875 (ROSS 82a)	0.885 (ROSS 82a)	0.914 (ROSS 82a)
10	0.875 (MACKAY 82a)			
15	0.823 (ROSS 82a) 0.874 (MACKAY 82a)	0.869 (ROSS 82a)	0.870 (ROSS 82a)	0.899 (ROSS 82a)
20	0.872 (MACKAY 82a)			
25	0.869 (MACKAY 82a)			

SABLE ISLAND CONDENSATE

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0	41	71	82
0	12.8 (MACKAY 82a)			
5	2.7 (ROSS 82a) 4.96 (MACKAY 82a)	88.0 (ROSS 82a)	2250 (ROSS 82a)	6600 (ROSS 82a)
10	3.39 (MACKAY 82a)			
15	2.02 (ROSS 82a) 2.96 (MACKAY 82a)	5.55 (ROSS 82a)	320 (ROSS 82a)	2450 (ROSS 82a)
20	2.67 (MACKAY 82a)			
25	2.41 (MACKAY 82a)			

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0	41	71	82
0	14.6 (MACKAY 82a)			
5	3.2 (ROSS 82a) 5.66 (MACKAY 82a)	100.6 (ROSS 82a)	2542 (ROSS 82a)	7221 (ROSS 82a)
10	3.87 (MACKAY 82a)			
15	2.45 (ROSS 82a) 3.39 (MACKAY 82a)	6.39 (ROSS 82a)	368 (ROSS 82a)	2725 (ROSS 82a)
20	3.06 (MACKAY 82a)			
25	2.77 (MACKAY 82a)			

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm): 28.5(ROSS 82a)

5.2 OIL-SEAWATER (mN/m or dynes/cm): 29.6(ROSS 82a)
18.4(MACKAY 82a)

SABLE ISLAND CONDENSATE

6.0 POUR POINT (°C):

WEATHERING (%)	POUR POINT (°C)
0	-22(ROSS 82a) 3(MACKAY 82a) -51(EETD 86)
41	3(ROSS 82a)
71	18(ROSS 82a)
82	27(ROSS 82a)

7.0 FLASH POINT (°C):

WEATHERING (%)	FLASH POINT (°C)
0	16(O.C.)(ROSS 82a) -11(C.C.)(EETD 86)
41	81(O.C.)(ROSS 82a)
71	135(O.C.)(ROSS 82a)
82	147(O.C.)(ROSS 82a)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME FRACTION	TEMPERATURE (°C)
0.15	103
0.30	123
0.50	156
0.70	220(ROSS 82a)

SABLE ISLAND CONDENSATE

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

	WEATHERING (%)
TEMP (°C)	0
0	0(EETD 86)
15	0(EETD 86)

10.2 EMULSION STABILITY:

	WEATHERING (%)
TEMP (°C)	0
0	0(EETD 86)
15	0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

	WEATHERING (%)
TEMP (°C)	0
0	N/M(EETD 86)
15	N/M(EETD 86)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED): OIL TO DISPERSANT RATIO OF 20 TO 1.

	WEATHERING (%)
TEMP (°C)	0
0	93.1(EETD 86)
15	93.4(EETD 86)

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

	WEATHERING (%)
TEMP (°C)	0
0	4.8(EETD 86)
15	27.8(EETD 86)

NOTE: LITTLE TENDENCY TO DISPERSE AT 5°C FOR FRESH AND 42% WEATHERED OIL(ROSS 82a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	88.4(MACKAY 82a) 81.04(ROSS 82a)
AROMATICS	10.8(MACKAY 82a)
POLARS	0.23(MACKAY 82a)
ASPHALTENES	0.60(MACKAY 82a)

14.0 WAX CONTENT (WT %): 2.01 (MACKAY 82a)

15.0 AQUEOUS SOLUBILITY (mg/L):

	WEATHERING (%)	
IN	0	42
SALT WATER	58.08(ROSS 82a) 11.93(MACLEAN 88)	5.34(ROSS 82a)
FRESH WATER @ 22°C	76.0(SUNTIO 86) 14.4(MACLEAN 88)	
DISTILLED WATER	74.65(ROSS 82a)	8.02(ROSS 82a)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

Sable Island Condensate:

48 hour EC_{50}:	0.41(MACLEAN 88) 2.1(BOBRA 88)
48 hour LC_{50}:	3.41(MACLEAN 88) 18(BOBRA 88)

Venture Condensate:

48 hour EC_{50}:	0.83(MACLEAN 88)
48 hour LC_{50}:	5.84(MACLEAN 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

Sable Island Condensate:

48 hour EC_{50}:	1.94(MACLEAN 88) 9.84(BOBRA 88)
48 hour LC_{50}:	2.58(MACLEAN 88) 13.13(BOBRA 88)

Venture Condensate:

48 hour EC_{50}:	3.72(MACLEAN 88)
48 hour LC_{50}:	4.33(MACLEAN 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY.
RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.
NOTE: Toxicity tests by Hutcheson used Venture Field
Condensate from intervals 4678 TO 4691 m.

RAINBOW TROUT (15 °C, FRESHWATER):

24 hour LC_{50}: 6.0 uL/L
96 hour LC_{50}: 5.6 uL/L
LTC: 5 uL/L
INCIPIENT LETHAL THRESHOLD CONC: 5 uL/L
ET_{50} (SWIMMING): < 1 H
EC_{50} (SWIMMING): <4.9 uL/L
(HUTCHESON 83)

16.0 TOXICITY continued:

GREEN SEA URCHIN (10 °C, SEAWATER):

LTC: ABOUT 40.5 uL/L
INCAPACITATED ABOUT 3.8 uL/L
NO ACUTE OR DELAY MORTALITIES UP TO 33.5 uL/L AFTER 96H
DELAY MORTALITIES > OR = 33.5 uL/L
(HUTCHESON 83)

17.0 SULPHUR (WT %): 0.03(EETD 86)

18.0 OTHERS:

18.1 COLOUR: CLEAR, PALE YELLOW(HUTCHESON 83)

18.2 FIRE POINT (°C):

WEATHERING (%)	FIRE POINT (°C)
0	16(ROSS 82a)
41	84(ROSS 82a)
71	141(ROSS 82a)
82	161(ROSS 82a)

18.3 H_2S (PPM): 0(ROSS 82a)

SOUR BLEND CRUDE OIL

1.0 TYPE: Sour Blend Crude Oil.

2.0 API GRAVITY (15/15 °C): 34.8(EETD 84)

3.0 DENSITY (g/mL):

For T between 0 and 25 °C:
DEN = 0.856 - 0.00077 T
where: DEN is density of fresh oil at T (g/mL)
T is oil temperature (°C)

TEMP (°C)	WEATHERING (WT %) 0	10	20
0	0.861(EETD 84) 0.852(MACKAY 82a)		
5	0.850(MACKAY 82a)		
10	0.847(MACKAY 82a)		
15	0.850(EETD 84) 0.842(MACKAY 82a)		
20	0.840 (MACKAY 82a)	0.861 (MACKAY 82a)	0.875 (MACKAY 82a)
25	0.836(MACKAY 82a)		

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

VISC = exp(3.189 - 4691.9 T/(273(T+273)))
where: VISC is dynamic viscosity of fresh oil at T (mPa.s)
exp is exponential base e
T is oil temperature (°C)

TEMP (°C)	WEATHERING (%) 0
0	24.2(MACKAY 82a) 26.7(TWARDUS 80)
5	16.9(MACKAY 82a)
10	10.9(MACKAY 82a) 19.4(TWARDUS 80)
15	8.20(MACKAY 82a)
20	6.59(MACKAY 82a) 9.5(TWARDUS 80)
25	5.95(MACKAY 82a)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	28.4(MACKAY 82a)
5	19.9(MACKAY 82a)
10	12.9(MACKAY 82a)
15	9.74(MACKAY 82a)
20	7.85(MACKAY 82a)
25	7.12(MACKAY 82a)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

	WEATHERING (%)
TEMP (°C)	0
15	25.8(EETD 84) 25.6(EETD 85)
ROOM	24.1(TWARDUS 80)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

	WEATHERING (%)
TEMP (°C)	0
15	0.75(EETD 84)

5.3 OIL-WATER (mN/m or dynes/cm):

	WEATHERING (%)
TEMP (°C)	0
15	13.0(EETD 85)
ROOM	27.5 (TWARDUS 80)

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	6(MACKAY 82a) -50(TWARDUS 80)
10	6(MACKAY 82a)
20	9(MACKAY 82a)

SOUR BLEND CRUDE OIL

7.0 FLASH POINT (°C): 6.6(C.C.)(EETD 84)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	VAPOUR TEMPERATURE	LIQUID TEMPERATURE
IBP	45	114
5		140
10	95	164
15		188
20	130	213
25		239
30	180	264(EETD 84)
40	235	
50	300	
60	345	
70	380	
80	385	
85	390(TWARDUS 80)	

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
0	0.58(EETD 84)
15	0(EETD 84)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (%) 0
0	0.9(EETD 84)
15	0.1(EETD 84)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (^{o}C)	WEATHERING (%)
	0
0	92.3(EETD 84)
15	N/M(EETD 84)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 5217\ \Theta\ \exp(6.3 - 3975.8/T_k)/T_k)}{(5217/T_k)}$$

where:
Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = ^{o}C + 273)
(EETD 84)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

GROUP	WEATHERING (WT %) 0	10	20
SATURATES	82.3	76.9	72.5
AROMATICS	13.2	14.7	16.4
POLARS	2.33	3.86	4.34
ASPHALTENES	2.21	4.58	6.73

(MACKAY 82a)

SOUR BLEND CRUDE OIL

14.0 WAX CONTENT (WT %):

WEATHERING (WT %)	WAX CONTENT (WT %)
0	5.62(MACKAY 82a)
10	8.49(MACKAY 82a)
20	9.95(MACKAY 82a)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 FIRE POINT (°C): <10.5(TWARDUS 80)

18.2 IN-SITU COMBUSTION OF FRESH OIL: EASILY IGNITED, 5.0 WT % RESIDUE(TWARDUS 80)

SOUTH CORMORANT CRUDE OIL

1.0 TYPE: South Cormorant Crude Oil (Cormorant "A") U.K., North Sea. Contributor to Brent system at Sullom Voe, Shetland Islands.

2.0 API GRAVITY (15/15°C): 35.7 (AALUND 83b)

3.0 DENSITY (g/mL): @15°C: 0.846 (AALUND 83b)

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -6.0 (AALUND 83b)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.56 (AALUND 83b)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1-C_4		2.8
GASOLINE	C_5-85	7.5
NAPHTHA	85-165	15.4
KEROSINE	165-235	12.9
GAS OIL	235-300	13.4
GAS OIL	300-350	7.9
RESIDUE	350+	40.5

(AALUND 83b)

SOUTH LOUISIANA CRUDE OIL

1.0 TYPE: South Louisiana Crude Oil.

2.0 API GRAVITY: 37.0(API 81)
34.5(PANCIROV 74)

3.0 DENSITY (g/mL): @ 15.6 °C: 0.839(API 81)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @38°C: 4.3(NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -9(NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)
5	76
10	105
15	132
20	156
25	178
30	203
35	221
40	239
45	254
50	271
55	284
60	302
65	321
70	341
75	362
80	384
85	411
90	440
95	468
FBP	530(API 81)

NOTE: (API 81) DATA FROM SIMULATED DISTILLATION ASTM METHOD D 2887

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	31(FINGAS 90)
CRX-8	36(FINGAS 90)
ENER 700	48(FINGAS 90)
DASIC	42(FINGAS 90)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	65.1
AROMATICS	26.3
POLARS	8.4
ASPHALTENES	0.2(CLARK 77)

14.0 WAX CONTENT (WT %): 1.06(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in seawater:	23.37(ANDERSON 74)
in distilled water:	37.9(MURRAY 84)

SOUTH LOUISIANA CRUDE OIL

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION:

SPECIES	24 hour LC_{50}	48 hour LC_{50}	96 hour LC_{50}
POLYCHAETA:			
PLATYNEREIS DUMERILII		12.3(NEFF 76)	9.5(NEFF 76)
NEANTHES ARENACEODENTATA	18.0(ROSSI 76)	13.9(ROSSI 76)	12.5(ROSSI 76)
CAPITELLA CAPITATA	>19.8(ROSSI 76)	16.2(ROSSI 76)	12.0(ROSSI 76)
CRUSTACEA:			
MYSIDOPSIS ALMYRA	11.7(ANDERSON 74)	8.7(ANDERSON 74)	
LEANDER TENUICORNIS		10.2(NEFF 76)	6.0(NEFF 76)
PALAEMONETES PUGIO	>16.8(ANDERSON 74)	>16.8(NEFF 76)	>16.8(NEFF 76)
PENAEUS AZTECUS	>19.8(ANDERSON 74)	>19.8(NEFF 76)	>19.8(NEFF 76)
FISH:			
MENIDIA BERYLLINA	9.7(ANDERSON 74)	8.7(NEFF 76)	5.5(NEFF 76)
FUNDULUS SIMILIS	16.8(ANDERSON 74)	16.8(NEFF 76)	16.8(NEFF 76)
CYPRINODON VARIEGATUS	>19.8(ANDERSON 74)	>19.8(NEFF 76)	>19.8(NEFF 76)

ACUTE TOXICITY OF OIL-IN-WATER DISPERSION:

SPECIES	24 hour LC50	48 hour LC50	96 hour LC50
CRUSTACEA:			
MYSIDOPSIS ALMYRA	165	37.5	
PALAEMONETES PUGIO	1,700	1,650	200
PENAEUS AZTECUS	>1,000	>1,000	>1,000
FISH:			
MENIDIA BERYLLINA	7,600	5,000	3,700
FUNDULUS SIMILIS	6,610	6,000	6,000
CYPRINODON VARIEGATUS	80,000	33,000	29,000

(ANDERSON 74)

17.0 SULPHUR (WT %):
0.21(API 81)
0.25(PANCIROV 74)

18.0 OTHERS:

18.1 NITROGEN (WT %):
0.031(API 81)
0.69(PANCIROV 74)
0.13(NSD 88)

18.2 METALS (PPM):
NICKEL:
1.1(API 81)
2.2(PANCIROV 74)
VANADIUM:
0.9(API 81)
1.9(PANCIROV 74)

SOUTH WEST TEXAS LIGHT CRUDE OIL

1.0 TYPE: South West Texas Light Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 41.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8210 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 1.40 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.08 (NSD 88)

18.0 OTHERS:

STATFJORD CRUDE OIL

1.0 TYPE: Statfjord Crude Oil (Norway and U.K., North Sea)

2.0 API GRAVITY (15/15°C): 38.4 (AALUND 83c)
38.2 (NSD 88)
37.8 (CORBETT 90)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (VOLUME %) 0	20.1	32.3	42.1
15.5	0.834 (DALING 88)	0.867 (DALING 88)	0.882 (DALING 88)	0.895 (DALING 88)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0	20.1	32.3	42.1
6	12 (DALING 88)	50 (DALING 88)	113 (DALING 88)	483 (DALING 88)
13	7 (DALING 88)	20 (DALING 88)	57 (DALING 88)	221 (DALING 88)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @15°C: 7.33 (AALUND 83c)
@20°C: 6.09 (CORBETT 90)
@38°C: 4.40 (NSD 88)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL:

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	20.1	32.3	42.1
13	23 (DALING 88)	16 (DALING 88)	15 (DALING 88)	16 (DALING 88)

STATFJORD CRUDE OIL

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-15(DALING 88) 4(AALUND 83c) -3(CORBETT 90)
20.1	7(DALING 88)
32.3	11(DALING 88)
42.1	16(DALING 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 37.9 (AALUND 83c)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.3 WATER CONTENT OF STABLE EMULSIONS (VOLUME %):

TEMP (°C)		WEATHERING (VOLUME %)	
	20.1	32.3	42.1
13	36(DALING 88)	77(DALING 88)	73(DALING 88)

NOTE: OIL WEATHERED 20.1(VOLUME %) DID NOT FORM A STABLE EMULSION (DALING 88).

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

FOR OIL WEATHERED 42.1% BY VOLUME:

SATURATES	56.2
AROMATICS	34.8
POLARS	7.8(DALING 88)

WEATHERING (VOLUME %)	ASPHALTENES(WT%) "hard"	"soft"
0	0.01(DALING 88)	0.39(DALING 88)
20.1	0.01(DALING 88)	0.47(DALING 88)
32.3	0.02(DALING 88)	0.54(DALING 88)
42.1	0.02(DALING 88)	0.63(DALING 88)

NOTE: ASPHALTENE CONTENT IS CALCULATED FROM DATA OF THE 250°C+ FRACTION, "HARD" ASPHALTENES: IP-143 METHOD, "SOFT" ASPHALTENES: n-PENTANE INSOLUBLE (DALING 88).

14.0 WAX CONTENT (WT %):

WEATHERING (VOLUME %)	WAX CONTENT (WEIGHT %)
0	4.14(DALING 88) 5.7(NSD 88)
20.1	4.78(DALING 88)
32.3	5.77(DALING 88)
42.1	6.68(DALING 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

0.27 (AALUND 83c)
0.28 (CORBETT 90)

STATFJORD CRUDE OIL

18.0 OTHERS:

18.1 METALS (PPM): NICKEL: 1.03(AALUND 83c)
VANADIUM: 0.53(AALUND 83c)
SODIUM: 13(CORBETT 90)

18.2 TOTAL NITROGEN (PPM): 1.03(AALUND 83c)

18.3 CARBON RESIDUE (WT %): 1.32(AALUND 83c)

18.4 YIELD ON CRUDE:

	RANGE, °C	VOLUME %	WEIGHT %
GASOLINE	C_5-65	4.44	3.47
LIGHT NAPHTHA	65-90	4.08	3.51
NAPHTHA	90-150	12.89	11.71
HEAVY NAPHTHA	150-180	6.06	5.69
LIGHT GAS OIL	180-240	10.70	10.38
GAS OIL	240-320	16.01	16.20
GAS OIL	320-375	9.34	9.72
HEAVY GAS OIL	375-420	5.24	5.56
HEAVY GAS OIL	420-525	15.79	17.07
HEAVY GAS OIL	525-565	3.72	4.14
RESIDUUM	565+	8.48	9.92

(CORBETT 90)

18.5 WATER CONTENT (VOL%): <0.05(CORBETT 90)

18.6 TOTAL ACID NO. (mg KOH/g): 0.06(CORBETT 90)

SWANSON RIVER CRUDE OIL

1.0 TYPE: Swanson River Crude Oil, Cook Inlet, Alaska.

2.0 API GRAVITY: 29.7(COLEMAN 78)

3.0 DENSITY (g/mL): @ 15.6°C: 0.878(COLEMAN 78)

4.0 VISCOSITY (Saybolt Universal seconds):

@ 25°C:	105(COLEMAN 78)
@ 37.8°C:	61(COLEMAN 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): <-15(COLEMAN 78)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

CUT TEMPERATURE (°C)	VOLUME PERCENT
26	IBP
50	1.9
75	4.8
100	7.7
125	12.9
150	18.9
175	23.4
200	27.4
225	31.7
250	36.5
275	43.2

(COLEMAN 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

SWANSON RIVER CRUDE OIL

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.16(COLEMAN 78)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 8.1(COLEMAN 78)

18.2 NITROGEN (WT %): 0.203(COLEMAN 78)

18.3 COLOUR: BROWNISH BLACK(COLEMAN 78)

SWEET BLEND CRUDE OIL

1.0 TYPE: Sweet Blend Crude Oil.

2.0 API GRAVITY (15/15°C): 38.6(MACKAY 82a)

3.0 DENSITY (g/mL):

DEN = 0.8406 - 0.0006 T
where: DEN is density of fresh oil at T (g/mL)
T is oil temperature (°C)

TEMP (°C)		WEATHERING (WT %)	
	0	10	20
0	0.840(MACKAY 82a)		
5	0.838(MACKAY 82a)		
10	0.835(MACKAY 82a)		
15	0.831(MACKAY 82a)		
20	0.829(MACKAY 82a)	0.847(MACKAY 82a)	0.859(MACKAY 82a)
25	0.825(MACKAY 82a)		

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

VISC = exp(2.89 - 4886.5 T/(273(T+273)))
where: VISC is dynamic viscosity of fresh oil at T
exp is exponential base e
T is oil temperature (°C)

TEMP (°C)	WEATHERING (%) 0
0	21.0(MACKAY 82a) 20.1(TWARDUS 80)
5	11.5(MACKAY 82a)
10	7.99(MACKAY 82a) 14.2(TWARDUS 80)
15	5.31(MACKAY 82a)
20	4.77(MACKAY 82a) 8.1(TWARDUS 80)
25	4.13(MACKAY 82a)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (%) 0
0	25(MACKAY 82a)
5	13.7(MACKAY 82a)
10	9.6(MACKAY 82a)
15	6.39(MACKAY 82a)
20	5.75(MACKAY 82a)
25	5.01(MACKAY 82a)

SWEET BLEND CRUDE OIL

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm): @ ROOM TEMP: 24(TWARDUS 80)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (WT %) 0	10	20
room	19.5 (MACKAY 82a)	16.9 (MACKAY 82a)	20.2 (MACKAY 82a)

5.3 OIL-WATER (mN/m or dynes/cm): @ ROOM TEMP: 27.3(TWARDUS 80)

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	-33(MACKAY 82a) -35(TWARDUS 80)
10	-27(MACKAY 82a)
20	6(MACKAY 82a)

7.0 FLASH POINT (°C): <9(O.C.)(TWARDUS 80)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMPERATURE (°C)
0	50
10	95
20	130
30	185
40	230
50	280
60	335
70	370
80	380
90	385(TWARDUS 80)

SWEET BLEND CRUDE OIL

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

GROUP	WEATHERING (WT %) 0	10	20
PARAFFINS	70.6	82.5	80.8
AROMATICS	21.0	11.9	12.8
POLARS	4.58	2.37	2.75
ASPHALTENES	3.78	3.20	3.62

(MACKAY 82a)

14.0 WAX CONTENT (WT %):

WEATHERING (WT %)	WAX (WT %)
0	2.18(MACKAY 82a)
10	3.02(MACKAY 82a)
20	3.41(MACKAY 82a)

15.0 AQUEOUS SOLUBILITY (mg/L): in distilled water: 63.5(MURRAY 84)

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 FIRE POINT (°C): 10(O.C.)(TWARDUS 80)

18.2 IN-SITU COMBUSTION OF FRESH OIL: EASILY IGNITED, 6.1 WT % RESIDUE(TWARDUS 80)

SYNTHETIC CRUDE OIL

1.0 TYPE: Synthetic Crude Oil from Syncrude, August 1986.

2.0 API GRAVITY (15/15°C): 32.6(EETD 86)

3.0 DENSITY (g/mL):

		WEATHERING (VOLUME %)	
TEMP (°C)	0	11.0	22.4
0	0.8721(EETD 86)	0.8969(EETD 86)	0.9160(EETD 86)
15	0.8614(EETD 86)	0.8868(EETD 86)	0.9058(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

		WEATHERING (VOLUME %)	
TEMP (°C)	0	11.0	22.4
0	8.8(EETD 86)	15.7(EETD 86)	41.7(EETD 86)
15	4.6(EETD 86)	8.9(EETD 86)	18.8(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

		WEATHERING (VOLUME %)	
TEMP (°C)	0	11.0	22.4
0	8.0(EETD 86)	19.7(EETD 86)	42.0(EETD 86)
15	5.3(EETD 86)	11.1(EETD 86)	20.3(EETD 86)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	11.0	22.4
0	28.1(EETD 86)	31.0(EETD 86)	31.6(EETD 86)
15	25.7(EETD 86)	28.4(EETD 86)	30.1(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	11.0	22.4
0	29.3(EETD 86)	18.6(EETD 86)	17.8(EETD 86)
15	29.0(EETD 86)	29.6(EETD 86)	15.5(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	11.0	22.4
0	31.3(EETD 86)	20.1(EETD 86)	19.2(EETD 86)
15	30.8(EETD 86)	30.5(EETD 86)	18.2(EETD 86)

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-72(EETD 86)
11.0	-45(EETD 86)
22.4	-36(EETD 86)

7.0 FLASH POINT (°C): <-21(C.C)(EETD 86)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	93.5	24.4
5	180	75.0
10	215	113
15	249	142
20	273	168
25	293	192
30	312	210
35	326	223
40	344	234
45	355	243
50	361	250
55	375	262
60	392	277
65	407	293
70	422	313
	(EETD 86)	(EETD 86)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (VOLUME %) 0	11.0	22.4
0	0(EETD 86)	0(EETD 86)	0(EETD 86)
15	0(EETD 86)	0(EETD 86)	0(EETD 86)

SYNTHETIC CRUDE OIL

10.2 EMULSION STABILITY:

		WEATHERING (VOLUME %)	
TEMP (°C)	0	11.0	22.4
0	0(EETD 86)	0(EETD 86)	0(EETD 86)
15	0(EETD 86)	0(EETD 86)	0(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

		WEATHERING (VOLUME %)	
TEMP (°C)	0	11.0	22.4
0	N/M(EETD 86)	N/M(EETD 86)	N/M(EETD 86)
15	N/M(EETD 86)	N/M(EETD 86)	N/M(EETD 86)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 6508\ \theta\ \exp(6.3 - 4312/T_k)/T_k)}{(6508/T_k)}$$

where:

Fv is fraction of oil weathered by volume
ln is natural log
θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273) (EETD 86)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	63(FINGAS 90)
CRX-8	41(FINGAS 90)
ENER 700	61(FINGAS 90)
DASIC	25(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 10(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	81.8
AROMATICS	17.0
POLARS	0.9
ASPHALTENES	0.3(EETD 86)

14.0 WAX CONTENT (WT %): 1.42(EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	29.9(SUNTIO 86)
in distilled water:	43.7(MURRAY 84)
in fresh water:	2.3(MACLEAN 88)
in seawater:	5.0(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHIA MAGNA:

48 hour EC_{50}:	0.23(MACLEAN 88) 3.0(BOBRA 88)
48 hour LC_{50}:	0.84(MACLEAN 88) 11.0(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

48 hour EC_{50}:	1.4(MACLEAN 88) 6.7(BOBRA 88)
48 hour LC_{50}:	1.88(MACLEAN 88) 9.0(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR (WT %)
0	0.23(EETD 86)
11.0	0.15(EETD 86)
22.4	0.20(EETD 86)

18.0 OTHERS:

TARSIUT A-25 CRUDE OIL

1.0 TYPE: Tarsiut A-25 Crude Oil, Beaufort Sea.

2.0 API GRAVITY: 30.8(DOME 84)

3.0 DENSITY (g/mL): @ 21 °C: 0.8711(DOME 84)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
20	5.432(DOME 84)
30	4.117(DOME 84)
40	3.155(DOME 84)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -31.9(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

TARSIUT CRUDE OIL

1.0 TYPE: Tarsiut Crude Oil.

2.0 API GRAVITY: 23.3 TO 30.2(GULF 83)
28.0(DOME 84)

3.0 DENSITY (g/mL):

For Fv < 16.4 % & T between 0 and 15 °C:
DEN = 0.888923 + 0.00066 Fv - 0.000324 T
where: DEN is density of oil at T and Fv (g/mL)
Fv is volume percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	0.884(EETD 84)	0.8998(EETD 85)	0.9021(EETD 85)
15	0.875(EETD 84) 0.895(GULF 83)	0.8900(EETD 85)	0.8922(EETD 85)
15.6	0.8868(DOME 84)		

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	12.3(EETD 84)	27.0(EETD 85)	28.8(EETD 85)
15	7.4(EETD 84)	13.4(EETD 85)	13.9(EETD 85)
20	7.148(DOME 84)		
30	5.386(DOME 84)		
40	4.141(DOME 84)		

TARSIUT CRUDE OIL

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	13.9(EETD 84)
15	8.5(EETD 84)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	28.0(EETD 84)	30.7(EETD 85)	30.8(EETD 85)
15	26.5(EETD 84)	29.1(EETD 85)	27.7(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	16.6(EETD 85)	18.0(EETD 85)	16.3(EETD 85)
15	14.1(EETD 85)	13.9(EETD 85)	14.3(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	20.0(EETD 84)	19.1(EETD 85)	18.5(EETD 85)
15	18.4(EETD 85)	17.9(EETD 85)	17.8(EETD 85)

TARSIUT CRUDE OIL

6.0 POUR POINT (°C): <-61(GULF 83)
<-60(DOME 84)

7.0 FLASH POINT (°C): 65(C.C.)(EETD 84)

8.0 VAPOUR PRESSURE (kPa): 0.8(EETD 84)

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	VAPOUR TEMPERATURE	LIQUID TEMPERATURE
0	82 TO 138	214
5		227
10	168 TO 198	237
15		248
20		261
25		274
30	227 TO 253	287
35		298
40		305
50	274 TO 306	(EETD 85)
70	334 TO 371	
90	431 TO 457	
FINAL	567 TO 610 (GULF 83)	

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	12.4	16.4
0	0(EETD 84)		
15	0(EETD 84)	0(EETD 85)	0(EETD 85)

TARSIUT CRUDE OIL

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	0(EETD 84)		
15	0(EETD 84)	0(EETD 85)	0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	N/M(EETD 84)		
15	N/M(EETD 84)	N/M(EETD 85)	N/M(EETD 85)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 2418\, \theta \exp(6.3 - 5016/T_k)/T_k)}{(2418/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(EETD 85)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED): OIL TO DISPERSANT RATIO : 20 TO 1.

TEMP (°C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	76(EETD 85)	57(EETD 85)	62(EETD 85)
15	81(EETD 85)	53(EETD 85)	72(EETD 85)

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

TEMP (^{o}C)	WEATHERING (VOLUME %) 0	12.4	16.4
0	38(EETD 85)	16(EETD 85)	17(EETD 85)
15	30(EETD 85)	22(EETD 85)	39(EETD 85)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	91.9
AROMATICS	7.4
POLARS	0.4
ASPHALTENES	0.3(EETD 86)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22^{o}C:	2.0(SUNTIO 86)
in fresh water:	8.20(MACLEAN 88)
in seawater:	7.2(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

48 hour EC_{50}:	3.47(MACLEAN 88) 0.85(BOBRA 88)
48 hour LC_{50}:	6.37(MACLEAN 88) 1.55(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

24 hour EC_{50}:	>7.2(MACLEAN 88) >1.6(BOBRA 88)
24 hour LC_{50}:	>7.2(MACLEAN 88) >1.6(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 0.09 TO 0.15(GULF 83)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 36(GULF 83)

18.2 METALS (PPM):	NICKEL:	0.5(GULF 83)
	VANADIUM:	0.34(GULF 83)
	COPPER:	1.57(GULF 83)
	IRON:	9.57(GULF 83)

TARTAN CRUDE OIL

1.0 TYPE: Tartan Crude Oil (UK, North Sea). Contributor to the Flotta system.

2.0 API GRAVITY (15/15°C): 41.7 (NSD 88)

3.0 DENSITY (g/mL): 0.8180 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 4.40°C: 11.6 (AALUND 83c)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -8.9 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): @38°C: 70.3 (AALUND 83c)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.56 (NSD 88)

18.0 OTHERS:

18.1 YIELD ON CRUDE:

	RANGE, °C	VOLUME %
C_1-C_4		3.5
NAPHTHA	C_5-65	5.7
NAPHTHA	65-150	20.0
NAPHTHA	150-180	7.1
KEROSINE	180-235	10.8
GAS OIL	235-300	12.3
GAS OIL	300-343	8.3
RESIDUE	343+	32.2

(AALUND 83c)

TERRA NOVA CRUDE OIL

1.0 TYPE: Terra Nova Crude Oil.

2.0 API GRAVITY:

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (WT %) 0
0	0.8713(EETD 89)
15	0.8560(EETD 89)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (WT %) 0
0	69(EETD 89)
15	22(EETD 89)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (WT %) 0
0	27.9(EETD 89)
15	27.2(EETD 89)

TERRA NOVA CRUDE OIL

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (WT %) 0
0	29.4(EETD 89)
15	28.8(EETD 89)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (WT %) 0
0	29.2(EETD 89)
15	28.7(EETD 89)

6.0 POUR POINT :

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 37.4(EETD 89)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (WT %) 0
15	0.43(EETD 89)

10.2 EMULSION STABILITY:

	WEATHERING (WT %)
TEMP (°C)	0
15	0(EETD 89)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

	WEATHERING (WT %)
TEMP (°C)	0
15	N/M(EETD 89)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	16(FINGAS 90)
CRX-8	11(FINGAS 90)
ENER 700	28(FINGAS 90)
DASIC	40(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 5(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.59(EETD 89)

14.0 WAX CONTENT (WT %): 0.89(EETD 89)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

TERRA NOVA K-08 DST #1 CRUDE OIL

1.0 TYPE: Terra Nova K-08 DST#1 Crude Oil.

2.0 API GRAVITY:

	WEATHERING (WT %)		
	0	5.0	14.9
	31.0 (PETRO-CAN 85)	29.5 (PETRO-CAN 85)	29.0 (PETRO-CAN 85)

3.0 DENSITY (g/mL):

TEMP (°C)	WEATHERING (WT %)		
	0	5.0	14.9
15	0.8704 (PETRO-CAN 85)	0.8786 (PETRO-CAN 85)	0.8809 (PETRO-CAN 85)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (WT %)		
	0	5.0	14.9
25	SOLID (PETRO-CAN 85)	SOLID (PETRO-CAN 85)	SOLID (PETRO-CAN 85)
50	8.7 (PETRO-CAN 85)	11.7 (PETRO-CAN 85)	17.8 (PETRO-CAN 85)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	27(PETRO-CAN 85)
5.0	30(PETRO-CAN 85)
14.9	33(PETRO-CAN 85)

TERRA NOVA K-08 DST #1 CRUDE OIL

7.0 FLASH POINT (°C):

WEATHERING (WT %)	FLASH POINT (°C)
0	<21(PETRO-CAN 85)
5.0	32(PETRO-CAN 85)
14.9	61(PETRO-CAN 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT		WEATHERING (WT %)	
	0	5.0	14.9
IBP	25	85	111
5	98	136	183
10	136	173	217
20	207	240	276
30	270	300	329
40	330	356	381
50	390	412	431
60	448	465	481
70	519	531	546
PERCENTAGE OFF AT 524 °C	70.5	69.1	66.9

(ASTM D 2887-MODIFIED)(PETRO-CAN 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (WT %) 0	5.0	14.9
1	0.15(ROSS 85)	0(ROSS 85)	0(ROSS 85)
15	1.0(ROSS 85)	1.0(ROSS 85)	0(ROSS 85)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (WT %) 0	5.0	14.9
1	1.0(ROSS 85)	0(ROSS 85)	0(ROSS 85)
15	1.0(ROSS 85)	1.0(ROSS 85)	0.93(ROSS 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (WT %) 0	5.0	14.9
1	49.3(ROSS 85)	0(ROSS 85)	0(ROSS 85)
15	88.9(ROSS 85)	84.6(ROSS 85)	57.6(ROSS 85)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

TERRA NOVA K-08 DST #1 CRUDE OIL

15.0 AQUEOUS SOLUBILITY (mg/L): in 35 ppt seawater @ 22°C:

WEATHERING (WT %)	SOLUBILITY (mg/L)
0	19.0(ROSS 85)
5.0	13.5(ROSS 85)
14.9	1.3(ROSS 85)

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (WT %)	SULPHUR (WT %)
0	0.70(PETRO-CAN 85)
5.0	0.74(PETRO-CAN 85)
14.9	0.80(PETRO-CAN 85)

18.0 OTHERS:

18.1 SPREADING COEFFICIENT ON SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (WT %)	
	0	5.0	14.9
1	DNS(ROSS 85)	DNS(ROSS 85)	DNS(ROSS 85)
15	DNS(ROSS 85)	DNS(ROSS 85)	DNS(ROSS 85)

NOTE: DNS=DID NOT SPREAD

TERRA NOVA K-08 DST #2 CRUDE OIL

1.0 TYPE: Terra Nova K-08 DST#2 Crude Oil.

2.0 API GRAVITY:

	WEATHERING (WT %)	
	0	5.0
	32.9 (PETRO-CAN 85)	30.3 (PETRO-CAN 85)

3.0 DENSITY (g/mL):

TEMP (°C)	0	WEATHERING (WT %) 5.0
15	0.8604 (PETRO-CAN 85)	0.8742 (PETRO-CAN 85)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	0	WEATHERING (WT %) 5.0
25	16.7 (PETRO-CAN 85)	26.5 (PETRO-CAN 85)
50	5.7 (PETRO-CAN 85)	7.8 (PETRO-CAN 85)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	12(PETRO-CAN 85)
5.0	15(PETRO-CAN 85)

7.0 FLASH POINT (°C):

WEATHERING (WT %)	FLASH POINT (°C)
0	<21(PETRO-CAN 85)
5.0	<21(PETRO-CAN 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	WEATHERING (WT %)	
	0	5.0
IBP	2	44
5	87	107
10	117	140
20	173	198
30	233	253
40	288	310
50	346	366
60	408	425
70	472	486
PERCENTAGE OFF AT 524 °C	76.0	75.1

(ASTM D 2887-MODIFIED)(PETRO-CAN 85)

TERRA NOVA K-08 DST#2 CRUDE OIL

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (WT %)	
	0	5.0	19.5
1	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)
15	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)

10.2 EMULSION STABILITY:

TEMP (°C)		WEATHERING (WT %)	
	0	5.0	19.5
1	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)
15	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)		WEATHERING (WT %)	
	0	5.0	19.5
1	90.1(ROSS 85)	87.6(ROSS 85)	51.1(ROSS 85)
15	90.0(ROSS 85)	89.4(ROSS 85)	88.8(ROSS 85)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

TERRA NOVA K-08 DST #2 CRUDE OIL

15.0 AQUEOUS SOLUBILITY (mg/L): in 35 ppt seawater @ 22°C:

WEATHERING (WT %)	SOLUBILITY (mg/L)
0	27.0(ROSS 85)
5.0	19.1(ROSS 85)
19.5	0.9(ROSS 85)

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (WT %)	SULPHUR (WT %)
0	0.69(PETRO-CAN 85)
5.0	0.71(PETRO-CAN 85)

18.0 OTHERS:

18.1 SPREADING COEFFICIENT ON SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (WT %)		
	0	5.0	19.5
1	DNS(ROSS 85)	DNS(ROSS 85)	DNS(ROSS 85)
15	9.0(ROSS 85)	5.2(ROSS 85)	DNS(ROSS 85)

NOTE: DNS=DID NOT SPREAD

TERRA NOVA K-08 DST #3 CRUDE OIL

1.0 TYPE: Terra Nova K-08 DST#3 Crude Oil.

2.0 API GRAVITY:

		WEATHERING (WT %)	
	0	5.0	14.8
	32.6 (PETRO-CAN 85)	30.5 (PETRO-CAN 85)	27.6 (PETRO-CAN 85)

3.0 DENSITY (g/mL):

		WEATHERING (WT %)	
TEMP (°C)	0	5.0	14.8
15	0.8620 (PETRO-CAN 85)	0.8729 (PETRO-CAN 85)	0.8891 (PETRO-CAN 85)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

		WEATHERING (VOLUME %)	
TEMP (°C)	0	5.0	14.8
25	18.7 (PETRO-CAN 85)	22.8 (PETRO-CAN 85)	201 (PETRO-CAN 85)
50	5.9 (PETRO-CAN 85)	8.2 (PETRO-CAN 85)	14.1 (PETRO-CAN 85)

5.0 INTERFACIAL TENSIONS:

TERRA NOVA K-08 DST#3 CRUDE OIL

6.0 POUR POINT (°C):

WEATHERING (WT %)	POUR POINT (°C)
0	12(PETRO-CAN 85)
5.0	18(PETRO-CAN 85)
14.8	24(PETRO-CAN 85)

7.0 FLASH POINT (°C):

WEATHERING (WT %)	FLASH POINT (°C)
0	<21(PETRO-CAN 85)
5.0	<21(PETRO-CAN 85)
14.8	52(PETRO-CAN 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT		WEATHERING (WT %)	
	0	5.0	14.8
IBP	1	69	115
5	86	116	168
10	117	147	202
20	176	208	259
30	238	266	312
40	297	321	366
50	356	379	421
60	420	438	477
70	487	502	547
PERCENTAGE OFF AT 524 °C	74.0	72.9	67.0

(ASTM D 2887-MODIFIED)(PETRO-CAN 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (WT %) 0	5.0	14.8
1	1.0(ROSS 85)	1.0(ROSS 85)	0.1(ROSS 85)
15	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)

10.2 EMULSION STABILITY:

TEMP (°C)	WEATHERING (WT %) 0	5.0	14.8
1	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)
15	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	WEATHERING (WT %) 0	5.0	14.8
1	88.3(ROSS 85)	87.1(ROSS 85)	76.1(ROSS 85)
15	90.1(ROSS 85)	90.1(ROSS 85)	90.0(ROSS 85)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY (mg/L): in 35 ppt seawater at 22°C:

WEATHERING (WT %)	SOLUBILITY (mg/L)
0	23.1(ROSS 85)
5.0	20.7(ROSS 85)
14.8	3.4(ROSS 85)

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (WT %)	SULPHUR (WT %)
0	0.68(PETRO-CAN 85)
5.0	0.71(PETRO-CAN 85)
14.8	0.76(PETRO-CAN 85)

18.0 OTHERS:

18.1 SPREADING COEFFICIENT ON SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (WT %)	
	0	5.0	14.8
1	DNS(ROSS 85)	DNS(ROSS 85)	DNS(ROSS 85)
15	9.8(ROSS 85)	8.0(ROSS 85)	DNS(ROSS 85)

NOTE: DNS=DID NOT SPREAD

TERRA NOVA K-08 DST#4 CRUDE OIL

1.0 TYPE: Terra Nova K-08 DST#4 Crude Oil.

2.0 API GRAVITY:

		WEATHERING (WT %)	
	0	5.1	14.2
	32.5 (PETRO-CAN 85)	30.4 (PETRO-CAN 85)	27.5 (PETRO-CAN 85)

3.0 DENSITY (g/mL):

		WEATHERING (WT %)	
TEMP (^oC)	0	5.1	14.2
15	0.8621 (PETRO-CAN 85)	0.8735 (PETRO-CAN 85)	0.8895 (PETRO-CAN 85)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

		WEATHERING (WT %)	
TEMP (^oC)	0	5.1	14.2
25	18.2 (PETRO-CAN 85)	27.3 (PETRO-CAN 85)	105 (PETRO-CAN 85)
50	5.9 (PETRO-CAN 85)	8.1 (PETRO-CAN 85)	13.8 (PETRO-CAN 85)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (^oC):

WEATHERING (WT %)	POUR POINT (^oC)
0	12(PETRO-CAN 85)
5.1	15(PETRO-CAN 85)
14.2	21(PETRO-CAN 85)

TERRA NOVA K-08 DST#4 CRUDE OIL

7.0 FLASH POINT (°C):

WEATHERING (WT %)	FLASH POINT (°C)
0	<21(PETRO-CAN 85)
5.1	<21(PETRO-CAN 85)
14.2	60(PETRO-CAN 85)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	WEATHERING (WT %)		
	0	5.1	14.2
IBP	3	76	130
5	90	120	175
10	119	151	210
20	177	210	267
30	234	264	320
40	290	316	377
50	345	370	434
60	405	427	494
70	467	484	
PERCENTAGE OFF AT 524 °C	77.0	75.6	64.2

(ASTM D 2887-MODIFIED)(PETRO-CAN 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (WT %)	
	0	5.1	14.2
1	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)
15	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)

10.2 EMULSION STABILITY:

TEMP (°C)		WEATHERING (WT %)	
	0	5.1	14.2
1	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)
15	1.0(ROSS 85)	1.0(ROSS 85)	1.0(ROSS 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)		WEATHERING (WT %)	
	0	5.1	14.2
1	89.8(ROSS 85)	86.7(ROSS 85)	67.5(ROSS 85)
15	87.4(ROSS 85)	93.9(ROSS 85)	89.3(ROSS 85)

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

TERRA NOVA K-08 DST #4 CRUDE OIL

15.0 AQUEOUS SOLUBILITY (mg/L): In 35 ppt seawater at 22°C:

WEATHERING (WT %)	SOLUBILITY (mg/L)
0	18.7(ROSS 85)
5.1	14.6(ROSS 85)
14.2	2.2(ROSS 85)

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (WT %)	SULPHUR (WT %)
0	0.67(PETRO-CAN 85)
5.1	0.69(PETRO-CAN 85)
14.2	0.74(PETRO-CAN 85)

18.0 OTHERS:

18.1 SPREADING COEFFICIENT ON SEAWATER (mN/m or dynes/cm):

TEMP		WEATHERING (WT %)	
(°C)	0	5.1	14.2
0	DNS(ROSS 85)	DNS(ROSS 85)	DNS(ROSS 85)
15	8.6(ROSS 85)	6.6(ROSS 85)	DNS(ROSS 85)

NOTE: DNS=DID NOT SPREAD

TEXAS GULF COAST HEAVY CRUDE OIL

1.0 TYPE: Texas Gulf Coast Heavy Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 27.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8900 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 11.0 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.25 (NSD 88)

18.0 OTHERS:

TEXAS GULF COAST LIGHT CRUDE OIL

1.0 TYPE: Texas Gulf Coast Light Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 35.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8500 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 4.5 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.03 (NSD 88)

18.0 OTHERS:

THISTLE CRUDE OIL

1.0 TYPE: Thistle Crude Oil (UK, North Sea). Contributor to Brent system at Sullom Voe, Shetland Islands.

2.0 API GRAVITY (15/15°C): 37.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8400 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 20°C: 5.87 (AALUND 83c)
@ 38°C: 4.3 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 12 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 51.7 (AALUND 83c)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 0.19 (NSD 88)

14.0 WAX CONTENT (WT %): 9.0 (NSD 88)
7.7 (AALUND 83c)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.31 (NSD 88)

18.0 OTHERS:

18.1 NICKEL/VANADIUM RATIO: 2.67 (NSD 88)

18.2 H_2S CONTENT (WT %): <0.01

THISTLE CRUDE OIL

18.3 YIELD ON CRUDE:

	RANGE, °C	WEIGHT %	VOLUME %
C_1-C_4		0.69	
GASOLINE	C_5-85	5.6	7.0
NAPHTHA	85-165	15.0	16.6
KEROSINE	165-235	11.9	12.6
LIGHT GAS OIL	235-300	12.9	12.9
HEAVY GAS OIL	300-350	9.8	9.6
RESIDUE	350+	43.8	39.8

(AALUND 83c)

TIA JUANA CRUDE OIL

1.0 TYPE: Tia Juana Crude Oil (Venezuela).

2.0 API GRAVITY (15/15°C): 26.7 (NSD 88)

3.0 DENSITY (g/mL): 0.8940 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 26.0 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -30.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.63 (NSD 88)

18.0 OTHERS:

TIA JUANA HEAVY CRUDE OIL

1.0 TYPE: Tia Juana Heavy Crude Oil (Venezuela).

2.0 API GRAVITY (15/15°C): 12.1 (NSD 88)

3.0 DENSITY (g/mL): 0.9850 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 50°C: 3.0 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -1.0 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT (WT %): 0.30 (NSD 88)

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 2.70 (NSD 88)

18.0 OTHERS:

TIA JUANA LIGHT CRUDE OIL

1.0 TYPE: Tia Juana Light Crude Oil (Venezuela).

2.0 API GRAVITY (15/15°C): 32.1 (NSD 88)

3.0 DENSITY (g/mL): 0.8650 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 10.4 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -43 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.10 (NSD 88)

18.0 OTHERS:

TRADING BAY CRUDE OIL

1.0 TYPE: Trading Bay Crude Oil, Offshore Cook Inlet, Alaska.

2.0 API GRAVITY: 31.0(COLEMAN 78)

3.0 DENSITY (g/mL): @ 15.6°C: 0.871(COLEMAN 78)

4.0 VISCOSITY (Saybolt Universal seconds):

@ 25°C:	66(COLEMAN 78)
@ 37.8 °C:	53(COLEMAN 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): <-15(COLEMAN 78)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

CUT TEMPERATURE (°C)	VOLUME PERCENT
28	IBP
50	1.6
75	4.0
100	9.7
125	15.5
150	19.9
175	24.3
200	28.5
225	32.7
250	37.6
275	45.4

(COLEMAN 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

TRADING BAY CRUDE OIL

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.05(COLEMAN 78)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 4.3(COLEMAN 78)

18.2 NITROGEN (WT %): 0.149(COLEMAN 78)

18.3 COLOUR: BROWNISH BLACK(COLEMAN 78)

TRADING BAY CRUDE OIL

1.0 TYPE: Trading Bay Crude Oil, Cook Inlet, Alaska.

2.0 API GRAVITY: 28.7(COLEMAN 78)

3.0 DENSITY (g/mL): @ 15.6°C: 0.883(COLEMAN 78)

4.0 VISCOSITY (Saybolt Universal seconds):

@ 25°C:	129(COLEMAN 78)
@ 37.8 °C:	83(COLEMAN 78)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -1(COLEMAN 78)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

CUT TEMPERATURE (°C)	VOLUME PERCENT
24	IBP
75	4.1
100	8.0
125	12.0
150	16.0
175	20.0
200	24.0
225	28.8
250	34.3
275	39.1

(COLEMAN 78)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

TRADING BAY CRUDE OIL

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.15(COLEMAN 78)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 2.8(COLEMAN 78)

18.2 NITROGEN (WT %): 0.192(COLEMAN 78)

18.3 COLOUR: BROWNISH BLACK(COLEMAN 78)

TRANSMOUNTAIN BLEND CRUDE OIL

1.0 TYPE: Transmountain Blend Crude Oil.

2.0 API GRAVITY (15/15°C): 33.8(EETD 84)

3.0 DENSITY (g/mL):

For Fv < 28.5 % & T between 0 and 15 °C:
DEN = 0.866996 + 0.002108 Fv - 0.000758 T
where: DEN is density of oil at T and Fv (g/mL)
Fv is volume percent of oil weathered
T is oil temperature (°C)

TEMP (°C)	WEATHERING (VOLUME %) 0	18.8	28.5
0	0.865(EETD 84)	0.9107(EETD 85)	0.9250(EETD 85)
15	0.855(EETD 84)	0.8989(EETD 85)	0.9127(EETD 85)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (VOLUME %) 0	18.8	28.5
0	650(EETD 85)	>10000(EETD 85)	>10000(EETD 85)
15	10.5(EETD 85)	142(EETD 85)	577(EETD 85)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)	WEATHERING (VOLUME %) 0	18.8	28.5
0	750(EETD 85)		
15	12.3(EETD 84)	158(EETD 85)	632(EETD 85)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	18.8	28.5
0	28.8(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	25.0(EETD 84)	29.1(EETD 85)	N/M(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	18.8	28.5
0	19.9(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	19.3(EETD 84)	25.1(EETD 85)	N/M(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (VOLUME %) 0	18.8	28.5
0	20.5(EETD 85)	N/M(EETD 85)	N/M(EETD 85)
15	19.3(EETD 84)	26.5(EETD 85)	N/M(EETD 85)

6.0 POUR POINT (°C):

WEATHERING (VOL %)	POUR POINT (°C)
0	2(EETD 85)
18.8	8(EETD 85)
28.5	18(EETD 85)

7.0 FLASH POINT (°C): -2.0(C.C.)(EETD 85)

8.0 VAPOUR PRESSURE (kPa): 45.7(EETD 84)

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE
IBP	113
5	144
10	174
15	203
20	234
25	265
30	295(EETD 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	0	WEATHERING (VOLUME %) 18.8	28.5
0	1.0(EETD 85)	1.0(EETD 85)	0(EETD 85)
15	0.2(EETD 84)	1.0(EETD 85)	1.0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (°C)	0	WEATHERING (VOLUME %) 18.8	28.5
0	1.0(EETD 85)	1.0(EETD 85)	0(EETD 85)
15	0.1(EETD 84)	1.0(EETD 85)	1.0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP ($^{\circ}$C)		WEATHERING (VOLUME %)	
	0	18.8	28.5
0	90.1(EETD 85)	75.4(EETD 85)	N/M(EETD 85)
15	N/M(EETD 84)	89.0(EETD 85)	87.0(EETD 85)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 6488\ \Theta \exp(6.3 - 3924.3/T_k)/T_k)}{(6488/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = $^{\circ}$C + 273)
(EETD 84)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILTY (% DISPERSED):

DISPERSANT	% EFFECTIVENESS
C9527	8(FINGAS 90)
CRX-8	8(FINGAS 90)
ENER 700	28(FINGAS 90)
DASIC	27(FINGAS 90)

12.2 NATURAL DISPERSIBILITY @15°C (% DISPERSED): 3(FINGAS 90a)

13.0 HYDROCARBON GROUP ANALYSIS (WT %):

SATURATES	81.0
AROMATICS	13.6
POLARS	1.9
ASPHALTENES	3.5(EETD 86)

14.0 WAX CONTENT (WT %): 1.39 (EETD 89)

15.0 AQUEOUS SOLUBILITY (mg/L):

in fresh water @ 22°C:	15.5(SUNTIO 86)
in fresh water:	7.9(MACLEAN 88)
in seawater:	5.56(MACLEAN 88)

16.0 TOXICITY (mg/L):

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO DAPHNIA MAGNA:

48 hour EC_{50}:	1.1(MACLEAN 88) 2.2(BOBRA 88)
48 hour LC_{50}:	4.27(MACLEAN 88) 8.4(BOBRA 88)

ACUTE TOXICITY OF WATER SOLUBLE FRACTION TO ARTEMIA SPP.:

24 hour EC_{50}:	3.61(MACLEAN 88) 8.0(BOBRA 88)
24 hour LC_{50}:	>5.56(MACLEAN 88) >12.4(BOBRA 88)

NOTE: RESULTS FROM (MACLEAN 88) OBTAINED BY FLUORESCENCE SPECTROSCOPY. RESULTS FROM (BOBRA 88) OBTAINED BY PURGE-AND-TRAP GC ANALYSIS.

17.0 SULPHUR (WT %): 0.79(EETD 89)

18.0 OTHERS:

TRANSOIL #10

1.0 TYPE: Transoil #10.
An oil in water dispersion (65% oil - 35% water) transported by AEC Pipelines, Edmonton, Alberta.

2.0 API GRAVITY:

3.0 DENSITY (g/ml):

TEMP (°C)	WEATHERING (VOLUME %) 0
0	1.0019(EETD 89)
15	0.9955(EETD 89)

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY (mg/L): ACUTE TOXICITY TO FINGERLING RAINBOW TROUT:
LC_{50}: 2000 (HARRIS 90)

17.0 SULPHUR:

18.0 OTHERS:

UKALERK 2C-50 CRUDE OIL

1.0 TYPE: Ukalerk 2C-50 Crude Oil.

2.0 API GRAVITY: 45.7(DOME 84)

3.0 DENSITY (g/mL): @ 21 °C: 0.7978(DOME 84)

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): 1.7(DOME 84)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

UVILUK CRUDE OIL

1.0 TYPE: Uviluk P-66 Crude Oil. Dome, Texaco et al., 1983.

2.0 API GRAVITY (15/15°C): 24.9(EETD 85)

3.0 DENSITY (g/mL): For fresh oil and T between 0 and 25 °C:
DEN = 0.91542 - 0.000727 T
where: DEN is density of oil at T
T is oil temperature (°C)

TEMP (°C)	WEATHERING (%) 0
0	0.9155(EETD 85)
15	0.9040(EETD 85)
20	0.9012(EETD 85)
25	0.8972(EETD 85)

4.0 VISCOSITY:

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
15	28.6(EETD 85)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
15	8.8(EETD 85)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)	WEATHERING (%) 0
15	21.4(EETD 85)

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	185	69
5	209	108
10	233	114
15	257	148
20	281	162
25	305	171
	(EETD 85)	(EETD 85)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)	WEATHERING (%) 0
15	0(EETD 85)

10.2 EMULSION STABILITY:

TEMP (^{o}C)	WEATHERING (%) 0
15	0(EETD 85)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (^{o}C)	WEATHERING (%) 0
15	N/M(EETD 85)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 4906\ \Theta\ \exp(6.3 - 4722/T_k)/T_k)}{(4906/T_k)}$$

where:

Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = ^{o}C + 273)
(EETD 85)

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

UVILUK CRUDE OIL

1.0 TYPE: Uviluk Crude Oil.

2.0 API GRAVITY (15/15°C): 29.4(EETD 86)

3.0 DENSITY (g/mL):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	9.7	20.0
0	0.8899(EETD 86)	0.9090(EETD 86)	0.9244(EETD 86)
15	0.8787(EETD 86)	0.8978(EETD 86)	0.9152(EETD 86)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	9.7	20.0
0	32.2(EETD 86)	88.6(EETD 86)	266.3(EETD 86)
15	13.8(EETD 86)	27.5(EETD 86)	67.1(EETD 86)

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt):

TEMP (°C)		WEATHERING (VOLUME %)
	0	20.0
0	28.6(EETD 86)	428.7(EETD 86)
15	15.7(EETD 86)	70.9(EETD 86)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	9.7	20.0
0	28.7(EETD 86)	32.7(EETD 86)	N/M(EETD 86)
15	26.7(EETD 86)	28.0(EETD 86)	29.8(EETD 86)

5.2 OIL-SEAWATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	9.7	20.0
0	23.5(EETD 86)	18.7(EETD 86)	N/M(EETD 86)
15	12.2(EETD 86)	13.8(EETD 86)	13.9(EETD 86)

5.3 OIL-WATER (mN/m or dynes/cm):

TEMP (°C)		WEATHERING (VOLUME %)	
	0	9.7	20.0
0	25.2(EETD 86)	24.8(EETD 86)	N/M(EETD 86)
15	24.3(EETD 86)	23.2(EETD 86)	22.8(EETD 86)

6.0 POUR POINT (°C):

WEATHERING (VOLUME %)	POUR POINT (°C)
0	-12(EETD 86)
9.7	- 3(EETD 86)
20.0	3(EETD 86)

UVILUK CRUDE OIL

7.0 FLASH POINT (°C): -9(C.C)(EETD 86)

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA (°C):

VOLUME PERCENT	LIQUID TEMPERATURE	VAPOUR TEMPERATURE
IBP	123	50
5	163	102
10	184	118
15	206	134
20	233	157
25	261	184
30	287	212
35	312	237
40	336	259
45	362	277
50	392	299
55	414	323
	(EETD 86)	(EETD 86)

10.0 EMULSION FORMATION TENDENCY & STABILITY:

10.1 EMULSION FORMATION TENDENCY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	9.7	20.0
0	1.0(EETD 86)	1.0(EETD 86)	1.0(EETD 86)
15	0.08(EETD 86)	1.0(EETD 86)	1.0(EETD 86)

10.2 EMULSION STABILITY:

TEMP (°C)		WEATHERING (VOLUME %)	
	0	9.7	20.0
0	0.31(EETD 86)	1.0(EETD 86)	1.0(EETD 86)
15	0(EETD 86)	0(EETD 86)	0.31(EETD 86)

10.3 WATER CONTENT OF STABLE EMULSION (VOLUME %):

TEMP (°C)	0	WEATHERING (VOLUME %) 9.7	20.0
0	95.8(EETD 86)	90.0(EETD 86)	69.7(EETD 86)
15	N/M(EETD 86)	N/M(EETD 86)	N/M(EETD 86)

11.0 WEATHERING:

$$Fv = \frac{\ln(1 + 5209\ \Theta\ \exp(6.3 - 4194/T_k)/T_k)}{(5209/T_k)}$$

where: Fv is fraction of oil weathered by volume
ln is natural log
Θ is evaporation exposure
exp is exponential base e
T_k is environmental temperature
(Kelvin, K = °C + 273)
(EETD 86)

12.0 DISPERSIBILITY:

12.1 CHEMICAL DISPERSIBILITY (% DISPERSED): OIL TO DISPERSANT RATIO : 20 TO 1.

TEMP (°C)	0	WEATHERING (VOLUME %) 9.7	20.0
0	54.5(EETD 86)	61.8(EETD 86)	64.0(EETD 86)
15	54.3(EETD 86)	58.4(EETD 86)	60.9(EETD 86)

12.2 NATURAL DISPERSIBILITY (% DISPERSED):

TEMP (°C)	0	WEATHERING (VOLUME %) 9.7	20.0
0	0(EETD 86)	0(EETD 86)	0(EETD 86)
15	7.6(EETD 86)	2.8(EETD 86)	0(EETD 86)

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %):

WEATHERING (VOLUME %)	SULPHUR CONTENT (WT %)
0	0.24(EETD 86)
9.7	0.17(EETD 86)
20.0	0.24(EETD 86)

18.0 OTHERS:

WABASCA BITUMEN

1.0 TYPE: Wabasca Bitumen. Method of production is cold bailing and centrifugation.

2.0 API GRAVITY: 11.0 to 18.1(ARC 87)

3.0 DENSITY (g/mL): 0.946 to 0.993(ARC 87)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
25	420 to 27,100(ARC 87)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS (WT %): ASPHALTENES: 10.3 to 15.2(ARC 87)

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 3.93 to 5.62(ARC 87)

18.0 OTHERS:

18.1 CARBON (WT %): 81.22 to 83.89(ARC 87)

18.2 HYDROGEN (WT %): 10.84 to 11.30(ARC 87)

18.3 NITROGEN (WT %): 0.30 to 1.23(ARC 87)

18.4 OXYGEN (WT %): 0.74 to 1.25(ARC 87)

18.5 METALS (PPM WT):
VANADIUM: 128.8 to 183.6(ARC 87)
NICKEL: 46.8 to 87.2(ARC 87)

18.6 RAMSBOTTOM CARBON RESIDUE (WT %): 7.2 to 9.2(ARC 87)

18.7 ASH (WT %): 0.09 to 0.50(ARC 87)

18.8 ACID NUMBER: 0.49 to 1.87(ARC 87)

WAINWRIGHT-KINSELLA CRUDE OIL

1.0 TYPE: Wainwright-Kinsella Crude Oil, Alberta.

2.0 API GRAVITY: 23.1(AALUND 83a)

3.0 DENSITY (g/mL): @ 21 °C: 0.9145(AALUND 83a)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 40 °C: 32.50(AALUND 83a)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -39.0(AALUND 83a)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 30.3(AALUND 83a)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (PPM): 15,800(AALUND 83a)

18.0 OTHERS:

18.1 CON. CARBON (WT %): 6.70(AALUND 83a)

18.2 METALS (PPM):	NICKEL:	40.30(AALUND 83a)
	VANADIUM:	79.90(AALUND 83a)

WAINWRIGHT-KINSELLA CRUDE OIL

18.3 YIELD ON CRUDE:

	RANGE, °C	VOL %
NAPHTHA	C_5-190	19.0
KEROSINE	190-277	12.0
DISTILLATE	277-343	11.0
GAS OIL	343-565	26.0
RESIDUE	565+	32.0

(AALUND 83a)

WEST GENERAL TEXAS CRUDE OIL

1.0 TYPE: West General Texas Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 40.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8250 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 1.40 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.20 (NSD 88)

18.0 OTHERS:

WEST SAK CRUDE OIL

1.0 TYPE: West Sak Crude Oil (Alaska).

2.0 API GRAVITY (15/15°C): 22.4(AALUND 83)(NSD 88)

3.0 DENSITY (g/mL): 0.9190(NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 15°C: 95.5(NSD 88)
@ 15.6°C:95.9(AALUND 83)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -50(AALUND 83)
-46(NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE (kPa): 18.6(AALUND 83)

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.82(AALUND 83)(NSD 88)

18.0 OTHERS:

18.1 CARBON RESIDUE (WT %): 7.62(AALUND 83)

18.2 METALS (PPM):	NICKEL:	22(AALUND 83)
	VANADIUM:	61(AALUND 83)

WEST TEXAS ELLENBURGER CRUDE OIL

1.0 TYPE: West Texas Ellenburger Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 47.6 (NSD 88)

3.0 DENSITY (g/mL): 0.7900 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 1.80 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT (°C): -32 (NSD 88)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.10 (NSD 88)

18.0 OTHERS:

WEST TEXAS LIGHT CRUDE OIL

1.0 TYPE: West Texas Light Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 42.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8200 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 3.30 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 0.25 (NSD 88)

18.0 OTHERS:

WEST TEXAS SOUR CRUDE OIL

1.0 TYPE: West Texas Sour Crude Oil (USA).

2.0 API GRAVITY (15/15°C): 34.0 (NSD 88)

3.0 DENSITY (g/mL): 0.8550 (NSD 88)

4.0 VISCOSITY:

4.2 KINEMATIC VISCOSITY (mm^2/sec or cSt): @ 38°C: 5.80 (NSD 88)

5.0 INTERFACIAL TENSIONS:

6.0 POUR POINT:

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR (WT %): 1.90 (NSD 88)

18.0 OTHERS:

WEYBURN-MIDALE CRUDE OIL

1.0 TYPE: Weyburn-Midale Crude Oil.

2.0 API GRAVITY:

3.0 DENSITY (g/mL): @ ROOM TEMP: 0.89(TWARDUS 80)

4.0 VISCOSITY:

4.1 DYNAMIC VISCOSITY (mPa.s or cP):

TEMP (°C)	WEATHERING (%) 0
0	88(TWARDUS 80)
10	29(TWARDUS 80)
20	18(TWARDUS 80)

5.0 INTERFACIAL TENSIONS:

5.1 AIR-OIL (mN/m or dynes/cm): @ ROOM TEMP: 24.1(TWARDUS 80)

5.2 OIL-WATER (mN/m or dynes/cm): @ ROOM TEMP: 29.7(TWARDUS 80)

6.0 POUR POINT (°C): -28(TWARDUS 80)

7.0 FLASH POINT:

8.0 VAPOUR PRESSURE:

9.0 DISTILLATION DATA:

VOLUME PERCENT	TEMP (°C)
0	45
10	90
20	130
30	190
40	230
50	265
60	275
70	335
80	385(TWARDUS 80)

WEYBURN-MIDALE CRUDE OIL

10.0 EMULSION FORMATION TENDENCY & STABILITY:

11.0 WEATHERING:

12.0 DISPERSIBILITY:

13.0 HYDROCARBON GROUP ANALYSIS:

14.0 WAX CONTENT:

15.0 AQUEOUS SOLUBILITY:

16.0 TOXICITY:

17.0 SULPHUR:

18.0 OTHERS:

18.1 FIRE POINT (°C): <14(TWARDUS 80)

18.2 IN-SITU COMBUSTION OF FRESH OIL: EASILY IGNITED, 7.4 VOL % RESIDUE (TWARDUS 80)

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